

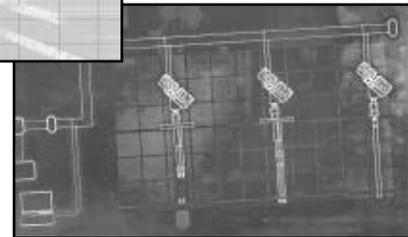
ECLIPSE[®]

Enhanced Model 705 with
PROFIBUS PA[™] Digital Output

705 software v3.x

PROFIBUS PA[™] Operating Manual

*Guided Wave Radar
Level Transmitter*



Read this Manual Before Installing

This manual provides information on the Enhanced Eclipse Model 705 transmitter with PROFIBUS PA™ Output and should be used in conjunction with Eclipse I&O manual 57-600. It is important that all instructions are read and followed carefully.

Safety Messages

The Eclipse system is designed for use in Category II, Pollution Degree 2 installations. Follow all standard industry procedures for servicing electrical and computer equipment when working with or around high voltage. Always shut off the power supply before touching any components. Although high voltage is not present in this system, it may be present in other systems.

Electrical components are sensitive to electrostatic discharge. To prevent equipment damage, observe safety procedures when working with electrostatic sensitive components.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

WARNING! Explosion hazard. Do not connect or disconnect designs rated Explosion proof or Non-incendive unless power has been switched off and/or the area is known to be non-hazardous

Low Voltage Directive

For use in Installations Category II, Pollution Degree 2. If equipment is used in a manner not specified by the manufacturer, protection provided by equipment may be impaired.

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Performance specifications are effective with date of issue and are subject to change without notice. Magnetrol reserves the right to make changes to the product described in this manual at any time without notice. Magnetrol makes no warranty with respect to the accuracy of the information in this manual.

Warranty

All Magnetrol electronic level and flow controls are warranted free of defects in materials or workmanship for one full year from the date of original factory shipment. If returned within the warranty period; and, upon factory inspection of the control, the cause of the claim is determined to be covered under the warranty; then, Magnetrol will repair or replace the control at no cost to the purchaser (or owner) other than transportation.

Magnetrol shall not be liable for misapplication, labor claims, direct or consequential damage or expense arising from the installation or use of equipment. There are no other warranties expressed or implied, except special written warranties covering some Magnetrol products.

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Magnetrol's quality assurance system is registered to ISO 9001 affirming its commitment to known international quality standards providing the strongest assurance of product/service quality available.





PROFIBUS PA™ Enhanced Eclipse Model 705 Guided Wave Radar Transmitter

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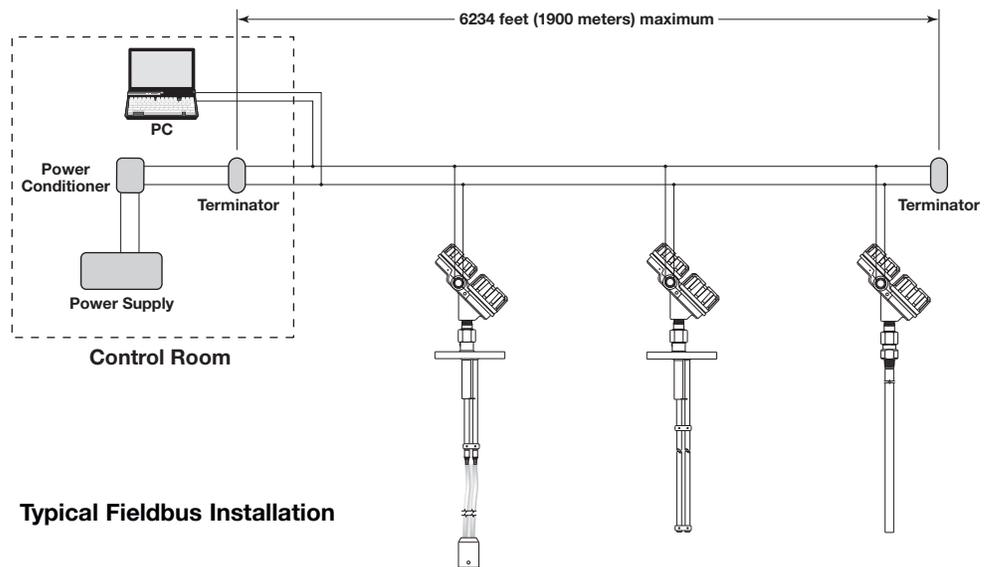
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1.0 PROFIBUS PA™ Overview

1.1 Description

PROFIBUS PA™ is a digital communications system that serially interconnects devices in the field. A fieldbus system is similar to a Distributed Control System (DCS) with two exceptions:

- Although a PROFIBUS PA™ system can use the same physical wiring as an existing 4–20 mA device, fieldbus devices are not connected point to point, but rather are multidropped and wired in parallel on a single pair of wires (referred to as a segment).
- PROFIBUS PA™ is a system that allows the user to distribute control across a network. Fieldbus devices are smart and actually maintain control over the system.



Unlike 4–20 mA analog installations in which the two wires carry a single variable (the varying 4–20 mA current), a digital communications scheme such as PROFIBUS PA™ considers the two wires as a network. The network can carry many process variables as well as other information. The Enhanced Eclipse Model 705PA transmitter is a PROFIBUS PA™ certified device that communicates with the DPV1 protocol operating at 31.25 kbits/sec. The MBP physical layer is an approved IEC 61158 standard.

An IEC61158 shielded twisted pair wire segment can be as long as 6234 feet (1900 meters) without a repeater. Up to 4 repeaters per segment can be used to extend the distance. The maximum number of devices allowed on a fieldbus segment is 32 although this depends on the current draw of the devices on any given segment.

Details regarding cable specifications, grounding, termination, and other network information can be found in IEC 61158 or the technical guideline “PROFIBUS PA™ User and Installation Guideline” at www.profibus.com.

1.2 Benefits

The benefits of PROFIBUS PA™ can be found throughout all phases of an installation:

1. **Design/Installation:** Connecting multiple devices to a single pair of wires means less wire and fewer I/O equipment. Initial Engineering costs are also reduced because PROFIBUS International requires interoperability, defined as “the ability to operate multiple devices in the same system, regardless of manufacturer, without a loss of functionality.” All PROFIBUS PA™ devices must be tested for interoperability by a PI accredited, independent testing agency. Magnetrol Model 705PA device certification information can be found at www.profibus.com.
2. **Operation:** A PROFIBUS PA™ system allows for multiple variables to be brought back from each device to the control room for additional trending and reporting.
3. **Maintenance:** The self-diagnostics residing in the smart field devices minimizes the need to send maintenance personnel to the field.

1.3 Device Configuration

The function of a PROFIBUS PA™ device is determined by the arrangement of a system of blocks. The types of blocks used in a typical User Application are described as follows:

Physical Block describes the characteristics of the PROFIBUS PA™ device such as the device name, manufacturer, and serial number.

Function Blocks are built into the PROFIBUS PA™ devices as needed to provide the desired control system behavior. There can be numerous function blocks in a single User Application.

Transducer Blocks contain information such as calibration parameters and sensor type. They are used to connect the sensor to the input function blocks.

An important requirement of fieldbus devices is the interoperability concept mentioned earlier. Device Description (DD) technology can provide extended descriptions for each object and provides pertinent information useful for a host system.

DDs are similar to the drivers that your personal computer (PC) uses to operate peripheral devices connected to it.

General PROFIBUS Information:

- The Model 705 supports PA Profile Version 3.0
- The Ident Number issued by the PNO for Magnetrol Model 705 3.x is 0x09B3. The Ident Number is included in the name of the GSD file.
- The General Station Description (GSD) file provides information on the features and performance capabilities of a PROFIBUS device to allow easy configuration of PROFIBUS networks with devices from different manufacturers. The manufacturer-specific GSD file for PA Model 705 3.x is Mag_09B3.gsd. Also, a bitmap file specified in the GSD file provides a symbolic representation of the device for network configuration tools.
- The Model 705 3.x can also use the profile-specific GSD file PA139703.gsd. If this general GSD file is used, the “Ident number Selector” parameter in the Physical Block must be set to the profile-specific ident number. The default selection of the “Ident Number Selector” parameter is the manufacturer-specific ident number.
- A Device Description is available for configuring the device using Simatic PDM.
- The range of device bus addresses is 0 to 126. 126 is the default address and all units will ship with address 126 unless a non-default address assignment is requested by the customer. The address can be changed via the fieldbus or the local LCD interface.

Additional information can be found at www.profibus.com.

1.3.1 PROFIBUS DD Revision Table

Model 705 3.x

DD Version	Release Date	Compatible with model 705 PA	
		Firmware	Software Revision
Dev V1 DD V1	December 2007	3.0K	V2.11
Dev V2 DD V1	March 2009	3.1C	V2.11 (Rev 2)

1.4 Intrinsic Safety

The IEC61158 physical layer supports Intrinsic Safety (IS) applications with bus-powered devices. To accomplish this, an IS barrier or galvanic isolator is placed between the power supply in the safe area and the device in the hazardous area.

IEC61158 also supports the Fieldbus Intrinsically Safe Concept (FISCO) model which allows more field devices in a network. The FISCO model considers the capacitance and inductance of the wiring to be distributed along its entire length. Therefore, the stored energy during a fault will be less and more devices are permitted on a pair of wires. Instead of the conservative entity model, which only allows about 90 mA of current, the FISCO model allows a maximum of 110 mA for Class II C installations and 240 mA for Class II B installations.

FISCO certifying agencies have limited the maximum segment length to 1000 meters because the FISCO model does not rely on standardized ignition curves.

The Enhanced Eclipse Model 705 is available with entity IS, FISCO IS, FNICO non-incendive, or explosion proof approvals.

2.0 QuickStart Installation

The QuickStart Installation procedures provide the key steps for mounting, wiring, and configuring the Eclipse level transmitter. These procedures are intended for experienced installers of electronic level measurement instruments. See Complete Installation, Section 3.0, for detailed installation instructions.

WARNING: The Model 7xD, 7xR or 7xT overfill probes should be used for Safety Shutdown/Overfill applications. All other Guided Wave Radar probes should be installed so the maximum overfill level is a minimum of 6" (150 mm) below the process connection. This may include utilizing a nozzle or spool piece to raise the probe. Consult factory to ensure proper installation.

2.1 Getting Started

Before beginning the QuickStart Installation procedures, have the proper equipment, tools, and information available.

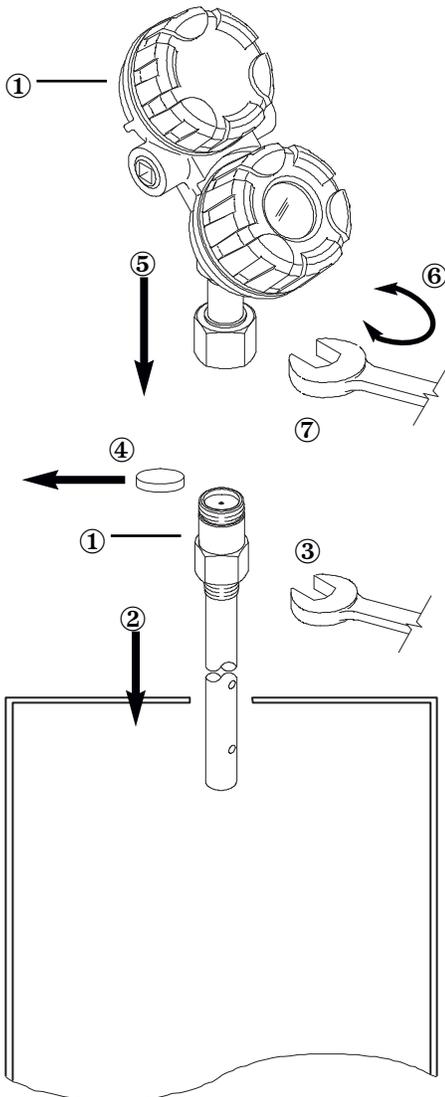
2.1.1 Equipment and Tools

- Open-end wrenches or adjustable wrench to fit the process connection size and type. Coaxial probe 1½" (38 mm), twin rod probe 1⅞" (47 mm), transmitter 1½" (38 mm). A torque wrench is highly desirable.
- Flat-blade screwdriver
- Cable cutter and ⅜" (2.5 mm) hex wrench (Flexible probes only)
- Fieldbus-compatible power supply with proper termination

2.1.2 Configuration Information

Some key information is needed to configure the Eclipse transmitter. Complete the following operating parameters table before beginning configuration.

Display	Question	Answer
Probe Model	What probe model is listed on the model information? (first four digits of probe model number)	_____
Probe Mount	Is the probe mounted NPT, BSP, or flange?	_____
Measurement Type	What is the desired measurement? Choices are: Level only, Volume, Interface Level or Interface Level and Volume.	_____
Probe Length	What probe length is listed on the model information? (last three digits of probe model number)	_____
Level Offset	The desired level reading when the liquid is at the end of the probe.	_____
Dielectric	What is the dielectric constant range of the process medium? (<i>Lower layer dielectric for interface applications</i>)	_____



2.2 QuickStart Mounting

NOTE: Confirm the configuration style and process connection size/type of the Eclipse transmitter. Ensure it matches the requirements of the installation before continuing with the QuickStart installation.

- ① Confirm the model and serial numbers on the nameplates of the Eclipse probe and transmitter are identical.

For applications using the Model 7xQ and 7xS steam probes, it is mandatory to keep the transmitter and probe matched as a set.

2.2.1 Probe

- ② Carefully place the probe into the vessel. Align the probe process connection with the threaded or flanged mounting on the vessel.

2.2.2 Transmitter

- ③ Tighten the hex nut of the probe process connection or flange bolts.

NOTE: Leave the plastic protective cap in place until ready to install the transmitter. Do not use sealing compound or TFE tape on probe connection to transmitter as this connection is sealed by a Viton® O-ring.

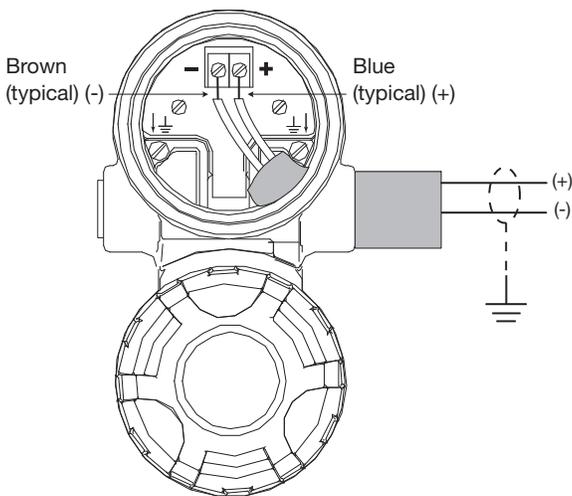
- ④ Remove the protective plastic cap from the top of the probe and store for future use. Make sure the top probe connector (female socket) is clean and dry. Clean with isopropyl alcohol and cotton swabs if necessary.
- ⑤ Place the transmitter on the probe. Align the universal connection at the base of the transmitter housing with the top of the probe. Hand tighten the connection.
- ⑥ Rotate the transmitter so that it is in the most convenient position for wiring, configuring, and viewing.
- ⑦ Using a 1½" (38 mm) wrench, tighten the universal connection on the transmitter ¼ to ½ turn beyond hand tight. A torque wrench is highly recommended to obtain 15 ft-lbs. This is a critical connection. **DO NOT LEAVE HAND TIGHT.**

2.3 QuickStart Wiring

WARNING! Explosion hazard. Do not connect or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

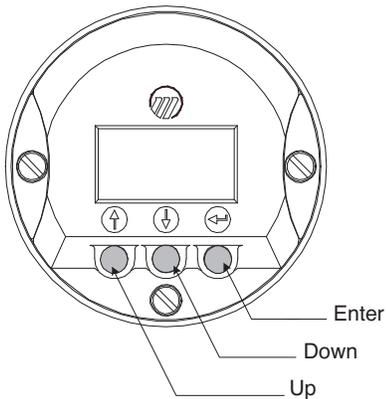
NOTE: Ensure that the electrical wiring to the Eclipse transmitter is complete and in compliance with all regulations and codes.

1. Remove the cover of the upper wiring compartment of the transmitter.
2. Attach a conduit fitting and mount the conduit plug in the spare opening. Pull the power supply wire through the conduit fitting.
3. Connect shield to an earth ground at power supply.
4. Connect the positive supply wire to the (+) terminal and the negative supply wire to the (-) terminal.
5. Replace the cover and tighten.



2.4 QuickStart Configuration

The Eclipse transmitter comes partially configured from the factory but can be reconfigured in the shop (disregard fault message due to unattached probe). The minimum configuration instructions required in the field follow. Use the information from the operating parameters table in Section 2.1.2 before beginning configuration.

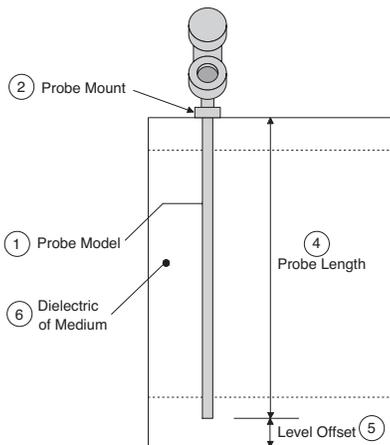


1. Power up the transmitter.
The display changes every 5 seconds to show one of two values: Status & Level.
2. Remove the cover of the lower electronic compartment.
3. Use the Up or Down Arrow (↑↓) keys to move from one step of the configuration program to the next step.
4. Press the Enter Arrow (↵) key. The last character in the first line of the display changes to an exclamation point (!).

PrbModel xxx

5. Use the Up or Down Arrow (↑↓) keys to increase or decrease the value in the display or to scroll through the choices.
6. Press the Enter Arrow (↵) key to accept a value and move to the next step of the configuration program (the default password is 0).
7. After entering the last value, allow 10 seconds before removing power from the transmitter.

The following configuration entries are the minimum required for configuration (the default password is 0 from the LCD/keypad).



- | | | |
|---|-----------------------|--|
| ① | PrbModel
(select) | Select the Probe Model to be used
Model 705: 7xA-x, 7xB-x, 7xD-x, 7xE-x, 7xF-F, 7xF-P, 7xF-4, 7xF-x, 7xJ-x, 7xK-x, 7xP-x, 7xQ-x, 7xR-x, 7xS-x, 7xT-x, 7x1-x, 7x2-x, 7x5-x, 7x7-x |
| ② | PrbMount
(select) | Select the type of Probe Mounting to vessel (NPT, BSP, or flange). |
| ③ | MeasType
(select) | Select from Level Only, Level and Volume, Interface Level or Interface Level and Volume. |
| ④ | Probe Ln
xxx.x | Enter the exact Probe Length as printed on the probe nameplate. |
| ⑤ | Lvloffst
xxx.x | Enter the Level Offset value. Refer to Section 2.6.6 for further information. (The unit is shipped from the factory with offset = 0; i.e., all measurements are referenced to the bottom of the probe). |
| ⑥ | Dielectrc
(select) | Enter the Dielectric range for the material to be measured. |

3.0 Complete Installation

This section provides detailed procedures for properly installing and configuring the Eclipse Guided Wave Radar Level Transmitter.

3.1 Unpacking

Unpack the instrument carefully. Make sure all components have been removed from the packing material. Check all the contents against the packing slip and report any discrepancies to the factory.

Before proceeding with the installation, do the following:

- Inspect all components for damage. Report any damage to the carrier within 24 hours.
- Make sure the nameplate model number on the probe and transmitter agree with the packing slip and purchase order.
- Record the model and serial numbers for future reference when ordering parts.

Model Number

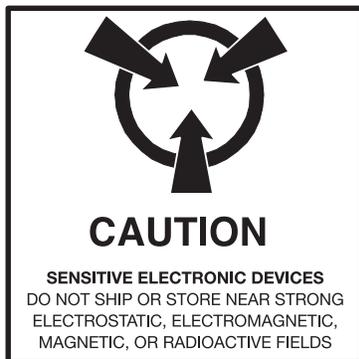
Serial Number

3.2 Electrostatic Discharge (ESD) Handling Procedure

Magnetrol's electronic instruments are manufactured to the highest quality standards. These instruments use electronic components that may be damaged by static electricity present in most work environments.

The following steps are recommended to reduce the risk of component failure due to electrostatic discharge.

- Ship and store circuit boards in anti-static bags. If an anti-static bag is not available, wrap the board in aluminum foil. Do not place boards on foam packing materials.
- Use a grounding wrist strap when installing and removing circuit boards. A grounded workstation is recommended.
- Handle circuit boards only by the edges. Do not touch components or connector pins.
- Make sure that all electrical connections are completely made and none are partial or floating. Ground all equipment to a good, earth ground.



3.3 Before You Begin

3.3.1 Site Preparation

Each Eclipse transmitter is built to match the specific physical specifications of the required installation. Make sure the probe connection is correct for the threaded or flanged mounting on the vessel or tank where the transmitter will be placed. See Mounting, Section 3.4.

Make sure that the wiring between the power supply and Eclipse transmitter are complete and correct for the type of installation.

When installing the Eclipse transmitter in a general purpose or hazardous area, all local, state, and federal regulations and guidelines must be observed.

3.3.2 Equipment and Tools

No special equipment or tools are required to install the Eclipse transmitter. The following items are recommended:

- Open-end wrenches or adjustable wrench to fit the process connection size and type. Coaxial probe 1½" (38 mm), twin rod probe 1⅞" (47 mm), transmitter 1½" (38 mm). A torque wrench is highly desirable.
- Flat-blade screwdriver
- Fieldbus-compatible power supply with proper termination

3.3.3 Operational Considerations

Operating specifications vary based on Probe model number.

3.4 Mounting

The Eclipse transmitter can be mounted to a tank using a variety of process connections. Generally, either a threaded or flanged connection is used. For information about the sizes and types of connections available, see Probe Model Numbers, Section 7.5.2.

NOTE: Do not place insulating material around any part of the Eclipse transmitter including the probe flange as this may cause excessive heat buildup.

Make sure all mounting connections are properly in place on the tank before installing the probe. Compare the nameplate on the probe and transmitter with the product information; make sure the Eclipse probe is correct for the intended installation.

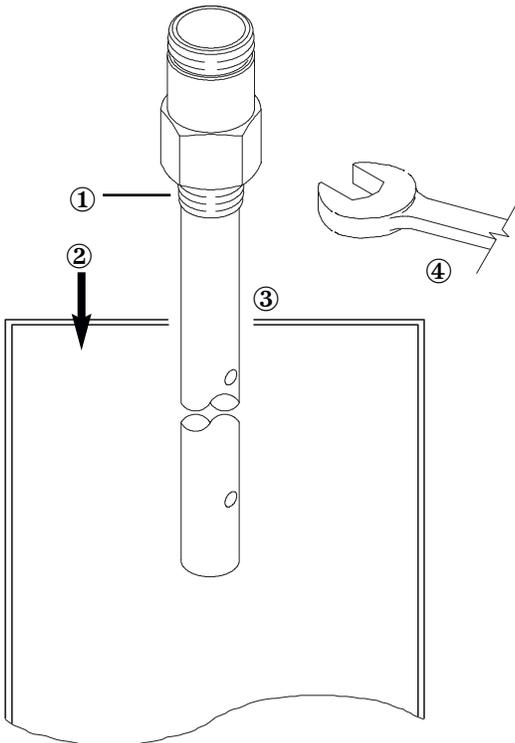
WARNING! The Model 7xD, 7xR or 7xT overfill probes should be used for Safety Shutdown/Overfill applications. All other Guided Wave Radar probes should be installed so the maximum overfill level is a minimum of 6" (150 mm) below the process connection. This may include utilizing a nozzle or spool piece to raise the probe. Consult factory to ensure proper installation.

WARNING! Do not disassemble probe when in service and under pressure.

3.4.1 Installing a Coaxial Probe (Models 7xA, 7xD, 7xP, 7xR, 7xQ, 7xS, and 7xT)

Before installing, make sure the:

- Model and serial numbers on the nameplates of the Eclipse probe and transmitter are identical.
- Probe has adequate room for installation and has unobstructed entry to the bottom of the vessel. The Model 7xD (High Temp./High Pressure) probe, Model 7xP (High Pressure) probe, Model 7xR (Overfill) probe, Model 7xS (Steam) probe and Model 7xT (Interface) probe require added clearance.
- Process temperature, pressure, dielectric, and viscosity are within the probe specifications for the installation.
- Model 7xD (High Temp./High Pressure) probes should be handled with extra care due to the ceramic spacers used throughout their length.



3.4.1.1 To install a coaxial probe:

- ① Make sure the process connection is at least $\frac{3}{4}$ " NPT or a flanged mounting.
- ② Carefully place the probe into the vessel. Align the gasket on flanged installations.
- ③ Align the probe process connection with the threaded or flanged mounting on the vessel.
- ④ For threaded connections, tighten the hex nut of the probe process connection. For flanged connections, tighten flange bolts.

NOTE: If the transmitter is to be installed at a later time, do not remove the protective cap from the probe. Do not use sealing compound or TFE tape on probe connection to transmitter as this connection is sealed by a Viton® O-ring.

3.4.2 Installing a Twin Rod Probe (Models 7xB, 7x5, and 7x7)

Before installing, make sure the:

- Model and serial numbers on the nameplates of the Eclipse probe and transmitter are identical.
- Probe has adequate headroom for installation and has unobstructed entry to the bottom of the vessel.
- Process temperature, pressure, dielectric, viscosity, and media buildup are within the probe specifications for the installation.

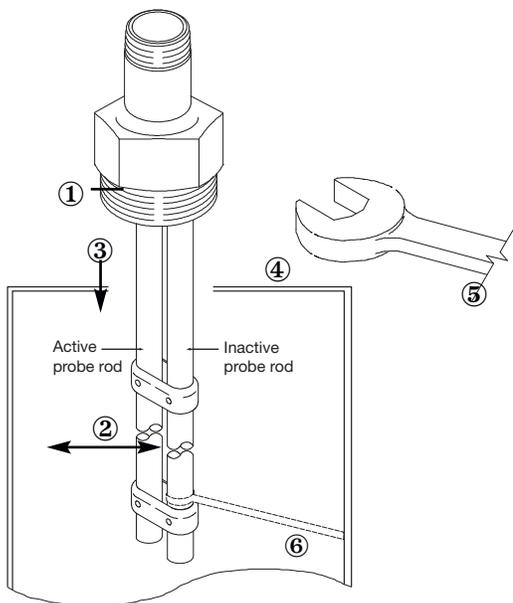
Nozzles:

The 7xB/7x5/7x7 Twin Rod probes may be susceptible to objects that are in close proximity. The following rules should be followed for proper application:

1. Nozzles should be 3" (80 mm) diameter or larger.
2. 7xB/7x5/7x7 Twin Rod probes should be installed such that the active rod is >1" (25 mm) from metallic objects such as pipes, ladders, etc., (a bare tank wall parallel to the probe is acceptable).

3.4.2.1 To install a rigid twin rod probe:

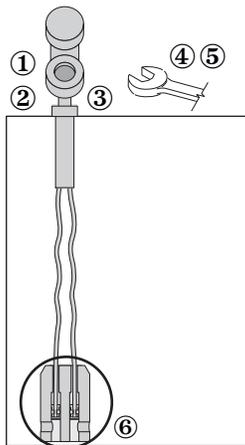
- ① Make sure the process connection is at least 2" NPT or a flanged mounting.
- ② Make sure that there is at least 1" (25 mm) spacing between the active probe rod and any part of the tank (walls, stillwell, pipes, support beams, mixer blades, etc.). Minimum stillwell diameter for Twin Rod probe is 3".
- ③ Carefully place the probe into the vessel. Align the gasket on flanged installations.
- ④ Align the probe process connection with the threaded or flanged mounting on the vessel.
- ⑤ For threaded connections, tighten the hex nut of the probe process connection. For flanged connections, tighten flange bolts.
- ⑥ Probe can be stabilized by attaching the inactive probe rod to vessel.



NOTE: If the transmitter is to be installed at a later time, do not remove the protective cap from the probe. Do not use sealing compound or TFE tape on probe connection to transmitter as this connection is sealed by a Viton® O-ring.

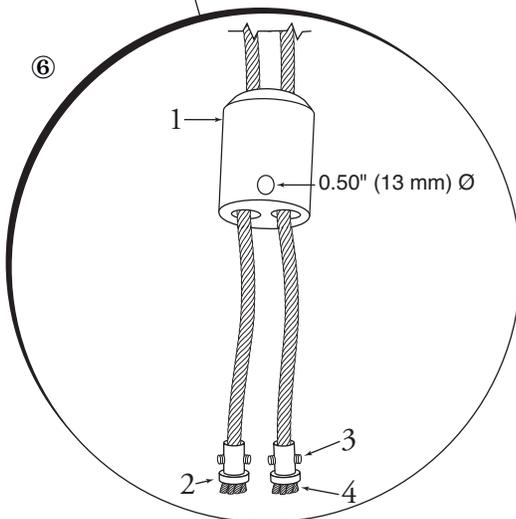
3.4.2.2 To install a Model 7x7 standard flexible twin rod probe:

- ① Make sure the process connection is at least 2" NPT or a flanged mounting.
- ② Make sure that there is at least 1" (25 mm) spacing between the active probe rod and any part of the tank (walls, stillwell, pipes, support beams, mixer blades, etc.). Minimum stillwell diameter for Twin Rod probe is 3".
- ③ Carefully place the probe into the vessel. Align the gasket on flanged installations.
- ④ Align the probe process connection with the threaded or flanged mounting on the vessel.
- ⑤ For threaded connections, tighten the hex nut of the probe process connection. For flanged connections, tighten flange bolts.



Probe can be shortened in the field:

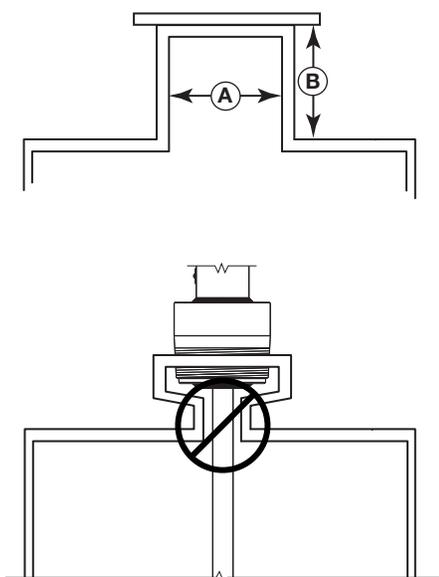
- ⑥ a. Raise the weight (1) to expose the two securing devices (2).
- b. Loosen the two #10-32 set screws (3) on both securing devices using a $\frac{3}{32}$ " (2.5 mm) hex wrench and slide the securing devices off of the probe.
- c. Slide the TFE weight off of the probe.
- d. Cut and remove the required cable (4) length.
- e. Remove $\frac{3}{8}$ " of the rib between the two cables.
- f. Strip $\frac{5}{8}$ " (16 mm) of coating from the two cables.
- g. Slide the TFE weight back on to the probe.
- h. Reattach securing device and tighten screws.
- i. Enter new probe length (inches or cm) in software.



3.4.3 Installing a Single Rod Probe (Models 7x1, 7x2, 7xF, 7xJ)

Before installing, make sure the:

- Model and serial numbers on the nameplates of the Eclipse probe and transmitter are identical.
- Probe has adequate headroom for installation and has unobstructed entry to the bottom of the vessel.
- Process temperature, pressure, dielectric, viscosity, and media buildup are within the probe specifications for the installation.
- Nozzle does not restrict performance by ensuring the following:
 1. Nozzle is <2" (50mm) diameter.

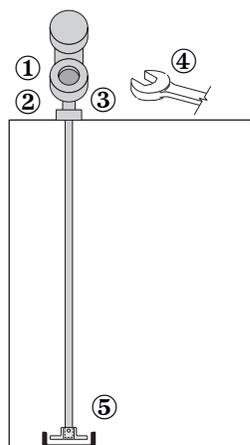


2. Ratio of Diameter: Length (A:B) is 1:1 or greater; any ratio <1:1 (e.g., a 2" x 6" nozzle = 1:3) may require a Blocking Distance and/or DIELECTRIC adjustment
 3. No pipe reducers (restrictions) are used.
- Probe is kept away from conductive objects to ensure proper performance. See Probe Clearance Table below. A lower gain (increase in DIELECTRIC setting) may be necessary to ignore certain objects.

PROBE CLEARANCE GUIDELINES

Distance to Probe	Acceptable Objects
<6"	Continuous, smooth, parallel conductive surface, for example a metal tank wall; important that probe does not touch wall
>6"	<1" (25mm) diameter pipe and beams, ladder rungs
>12"	<3" (75mm) diameter pipe and beams, concrete walls
>18"	All remaining objects

3.4.3.1 To install a Model 7xF rigid single rod probe:

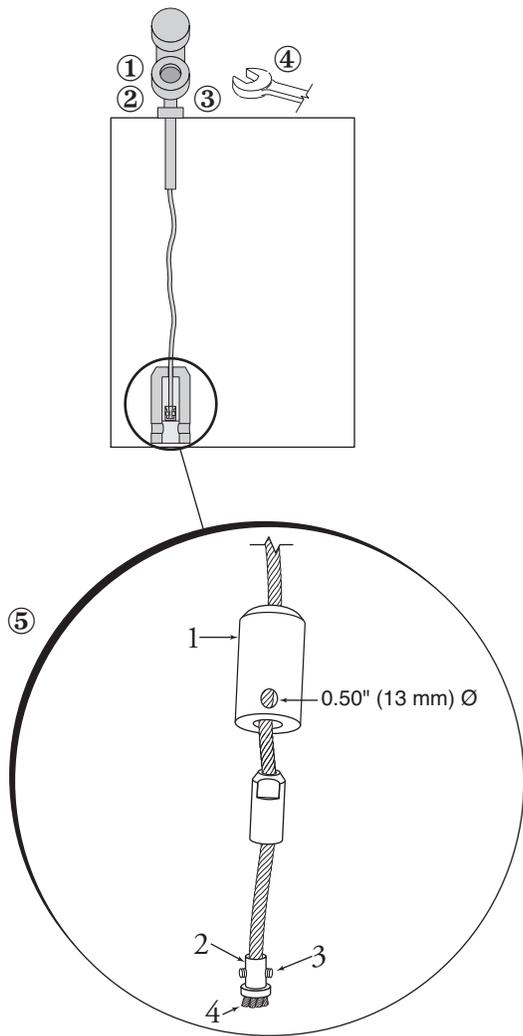


- ① Make sure the process connection is at least 2" NPT or a flanged mounting.
- ② Carefully place the probe into the vessel. Align the gasket on flanged installations.
- ③ Align the probe process connection with the threaded or flanged mounting on the vessel.
- ④ For threaded connections, tighten the hex nut of the probe process connection. For flanged connections, tighten flange bolts.
- ⑤ Probe can be stabilized by placing into a non-metallic cup or bracket at the bottom of the probe. A TFE bottom spacer (P/N 89-9114-001) is optional for mounting into a metallic cup or bracket.

NOTE: If the transmitter is to be installed at a later time, do not remove the protective cap from the probe. Do not use sealing compound or TFE tape on probe connection to transmitter as this connection is sealed by a Viton® O-ring.

3.4.3.2 To install a Model 7x1 flexible single rod probe:

- ① Make sure the process connection is at least 2" NPT or a flanged mounting.
- ② Carefully place the probe into the vessel. Align the gasket on flanged installations.



- ③ Align the probe process connection with the threaded or flanged mounting on the vessel.
- ④ For threaded connections, tighten the hex nut of the probe process connection. For flanged connections, tighten flange bolts.
- ⑤ Probe can be shortened in field:
 - a. Raise TFE weight (1) exposing securing device (2).
 - b. Loosen both #10–32 set screws (3) using $\frac{3}{32}$ " (2.5 mm) hex wrench and remove securing device.
 - c. Cut and remove needed cable (4) length.
 - d. Reattach securing device and tighten screws.
 - e. Enter new probe length (inches or cm) in software.
- ⑥ Probe can be attached to the tank bottom using the 0.50" (13 mm) \varnothing hole provided in the TFE weight. Cable tension should not exceed 20 lbs.

3.4.4 Installation Guidelines

Models 7x2/7x5 Bulk Solids Probes

The Model 7x2 and 7x5 Bulk Solids probes are designed for a 3000 lb. (1360 kg) pull-down force for use in applications such as sand, plastic pellets and grains. It is offered with a maximum 75 foot (22 meter) probe length.

Model 7x2 Single Rod — dielectric ≥ 4

Model 7x5 Twin Rod — dielectric ≥ 1.9

NOTE: Avoid cement, heavy gravel, etc.

3.4.4.1 Applications

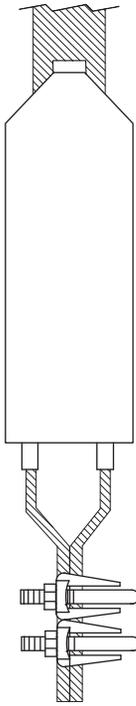
1. Plastic pellets, sugar: Dielectric constant 1.9-2.0
2. Grain, seeds, sand: Dielectric constant 2.0-3.0
3. Salts: Dielectric constant 4.0-7.0
4. Metallic powder, coal dust: Dielectric constant >7

3.4.4.2 Mounting recommendations

1. Use a weight instead of securing the probe to the vessel.
2. Mount probe at least 12 inches from the wall. Ideal location is $\frac{1}{4}$ to $\frac{1}{2}$ the diameter to average the angle of repose.
3. A metal flange must be used when mounting on plastic vessels.

3.4.4.3 To install a Model 7x5 bulk solids flexible twin rod probe:

- ① Make sure the process connection is at least 2" NPT or a flanged mounting.

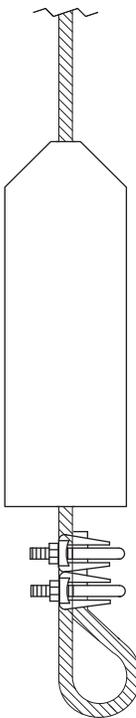


**Model 7x5 Dual Rod
Bulk Solids Probe**

- ② Make sure that there is at least 1" (25 mm) spacing between the active probe rod and any part of the tank (walls, stillwell, pipes, support beams, mixer blades, etc.). Minimum stillwell diameter for Twin Rod probe is 3".
- ③ Carefully place the probe into the vessel. Align the gasket on flanged installations.
- ④ Align the probe process connection with the threaded or flanged mounting on the vessel.
- ⑤ For threaded connections, tighten the hex nut of the probe process connection. For flanged connections, tighten flange bolts.

Probe can be shortened in the field:

- ⑥ a. Loosen and remove the two cable clamps.
- b. Slide the weight off of the probe.
- c. Cut the cable to the required length.
- d. Remove 12 inches of the rib between the two cables.
- e. Strip 6 inches of coating from the two cables.
- f. Slide the weight back on to the probe.
- g. Reinstall the two cable clamps and tighten.
- h. Enter the new probe length (inches or cm) in software.



**Model 7x2 Single Rod
Bulk Solids Probe**

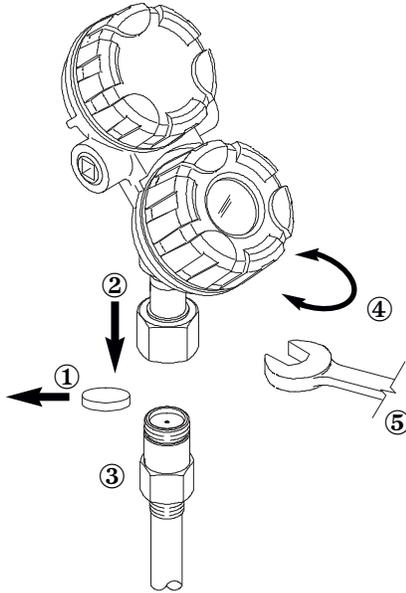
3.4.4.4 To install a Model 7x2 bulk solids flexible single rod probe:

- ① Make sure the process connection is at least 2" NPT or a flanged mounting.
- ② Carefully place the probe into the vessel. Align the gasket on flanged installations.
- ③ Align the probe process connection with the threaded or flanged mounting on the vessel.
- ④ For threaded connections, tighten the hex nut of the probe process connection. For flanged connections, tighten flange bolts.
- ⑤ Probe can be shortened in field:
- ⑥ a. Loosen and remove the two cable clamps.
- b. Slide the weight off of the probe.
- c. Cut the cable to the required length plus 6.38".
- d. Slide the weight back on to the probe.
- e. Reinstall the two cable clamps and tighten.
- f. Enter the new probe length (inches or cm) in software.

3.4.5 Installing the Transmitter

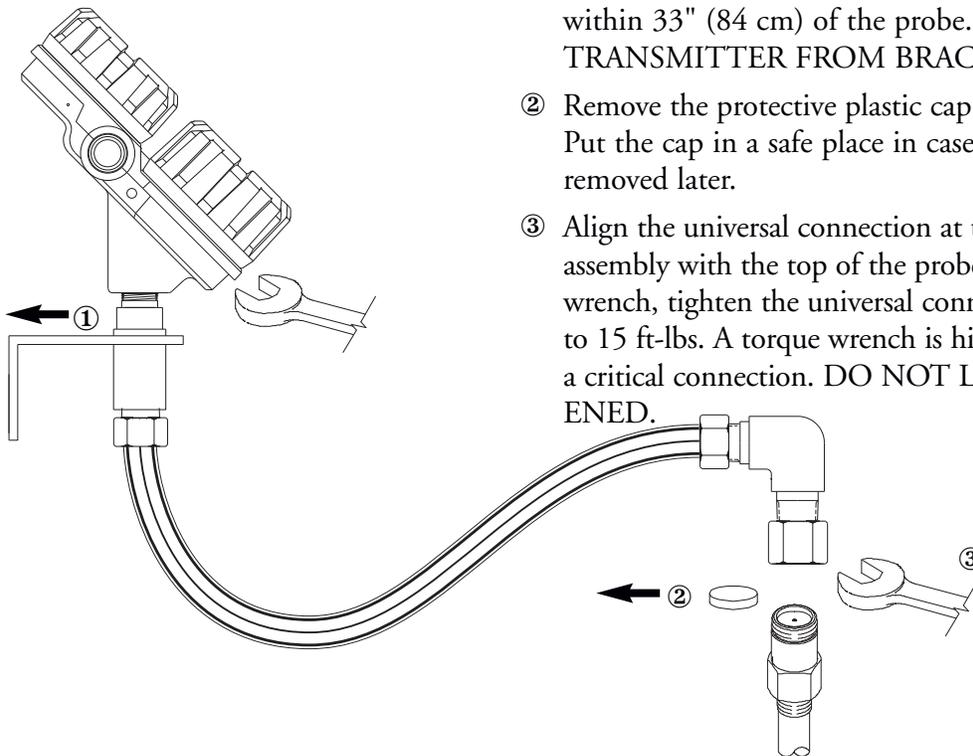
The transmitter can be ordered for installation as an Integral or Remote configuration.

3.4.5.1 Integral Mount



- ① Remove the protective plastic cap from the top of the probe. Put the cap in a safe place in case the transmitter has to be removed later.
- ② Place the transmitter on the probe. Be careful not to bend or dirty the gold, high frequency (male) connector.
- ③ Align the universal connection at the base of the transmitter housing with the top of the probe. Hand-tighten the connection.
- ④ Rotate the transmitter to face the most convenient direction for wiring, configuration, and viewing.
- ⑤ When the transmitter is facing the desired direction, use a 1½" (38 mm) wrench to tighten the universal connection on the transmitter to 15 ft-lbs. A torque wrench is highly recommended. This is a critical connection. **DO NOT LEAVE HAND-TIGHTENED.**

3.4.5.2 Remote Mount



- ① Mount the transmitter/remote bracket as an assembly within 33" (84 cm) of the probe. **DO NOT REMOVE TRANSMITTER FROM BRACKET.**
- ② Remove the protective plastic cap from the top of the probe. Put the cap in a safe place in case the transmitter has to be removed later.
- ③ Align the universal connection at the end of the remote assembly with the top of the probe. Using a 1½" (38 mm) wrench, tighten the universal connection on the transmitter to 15 ft-lbs. A torque wrench is highly recommended. This is a critical connection. **DO NOT LEAVE HAND-TIGHTENED.**

4.0 Function Blocks

4.1 Overview

The Enhanced Eclipse Model 705 Guided Wave Radar Level Transmitter operates on the principle of Time Domain Reflectometry (TDR). Refer to Bulletins 57-101 and 57-600 for more detailed information on the Eclipse product family.

The Enhanced Eclipse Model 705PA is a Guided Wave Radar (GWR) level transmitter with six PROFIBUS PA™ Blocks (one Physical Block, one Transducer Block, and four Analog Input blocks). The idea of Function Blocks, which a user can customize for a particular application, is a key concept of fieldbus topology. Function Blocks consist of an algorithm, inputs and outputs, and a user-defined name.

The TRANSDUCER block output is available to the network through the ANALOG INPUT blocks.

The ANALOG INPUT blocks (AI) take the TRANSDUCER block level or volume values and makes them available as an analog value to the network. The AI blocks have scaling conversion, filtering, and alarm functions.

4.1.1 Standard PROFIBUS™ Block Parameters

The following are general descriptions of the parameters common to all blocks. Additional information for a given parameter is described later in that specific block section.

BLOCK_OBJECT: Contains the characteristics of the block. This object applies to every block and is placed before the first parameter.

ST_REV A read-only parameter to track changes of static parameters in the associated block. ST_REV will be incremented each time a static parameter is changed.

TAG_DESC (tag descriptor): A user-supplied description of the block.

STRATEGY: A user-specified value that may be used in configuration or diagnostics as a key in sorting block information.

ALERT_KEY: A user-assigned value that may be used in sorting alarms or events generated by a block.

TARGET_MODE: This attribute indicates what mode of operation is desired for the block.

MODE_BLK: A structured parameter composed of the actual mode, the normal and the permitted mode(s) of a block.

The actual mode is set by the block during its execution to reflect the mode used during execution

The permitted mode shows which changes of the target mode are valid for the specific block

ALARM_SUM: This parameter summarized the status of up to 16 block alarms.

4.2 Physical Block

The Physical Block contains data specific to the Enhanced Model 705 PA transmitter, along with some information about the firmware.

NOTE: The Physical Block has no control function.

MODE_BLK: Actual mode must be in AUTO in order for the AI Function blocks in the transmitter to operate.

NOTE: A Physical Block in “out of service” will stop all function block execution in the transmitter.

SOFTWARE_REVISION: Revision number of the software of the field device.

HARDWARE_REVISION: Revision number of the hardware of the field device.

DEVICE_MAN_ID: Identification code of the manufacturer of the field device.

DEVICE_ID: Manufacturer specific identification of the device.

DEVICE_SER_NUM: Serial number of the device.

DIAGNOSIS: Detailed information about the device, bitwise coded.

DIAGNOSIS_EXTENSION: Additional detailed information about the device.

DIAGNOSIS_MASK: Definition of supported DIAGNOSIS information-bits.

0 = not supported

1 = supported

DIAGNOSIS_MASK_EXTENSION: Definition of supported DIAGNOSIS_EXTENSION information-bits.

0 = not supported

1 = supported

DEVICE CERTIFICATION: Pertinent certifications of the device.

WRITE_LOCKING: Software write-protection can be enabled or disabled.

FACTORY_RESET: Command for resetting the device for default values. The setting of the bus address is not affected.

- **RESTART_WITH_DEFAULTS:** As RESTART DEFAULT will set all configuration parameters to their default values. Devices need to be reconfigured following activation of this function. The bus address is not affected.
- **WARM_START:** No parameters changed
- **RESET_ADDRESS_TO_DEFAULT:** Other parameter unchanged

DESCRIPTOR: User-definable text string to describe the device within the application.

DEVICE_MESSAGE: User-definable message string used to describe the device within the application of in the plant.

DEVICE_INSTAL_DATE: Installation date of the device.

IDENT_NUMBER_SELECTOR: Selects manufacturer-specific Ident number issued by PNO or profile-specific Ident number to determine features and behavior for interacting with device.

HW_WRITE_PROTECTION: Indicates the position of a write block mechanism (e.g., hardware jumper).

4.3 GWR Transducer Block

The GWR TRANSDUCER block is a custom block containing parameters that support the Enhanced Eclipse Model 705 level transmitter. It contains the GWR probe configuration, diagnostics, and calibration data, and outputs level with status information.

The TRANSDUCER block parameters are grouped in a useful configuration. There are both read-only parameters and read-write parameters within the TRANSDUCER block.

- The read-only parameters report the block status and operation modes.
- The read-write parameters affect the function block basic operation, level transmitter operation, and calibration.

The Transducer Block remains in AUTO mode even when the local interface (keypad) is used to change a parameter online.

4.3.1 GWR Transducer Block Parameters

The first eight parameters in the GWR TRANSDUCER block are the standard block parameters discussed in section 4.1.1. The standard parameters are followed by these additional required parameters for a Level Transducer Block: Corresponding parameter names from Profile specification are shown parenthetically if different from parameter names used by Model 705.

LEVEL (PRIMARY_VALUE): The process value Level is Probe Level + Level Offset and an associated status.

LEVEL_UNIT (PRIMARY_VALUE_UNIT): Unit of measurement for level process variable (primary value).

PROBE_LEVEL (LEVEL): Level on the probe relative to the end of the probe in Probe Level units.

PROBE_LEVEL_UNIT (LEVEL_UNIT): Unit of measurement for probe level parameters: Level Offset, Probe Level, Probe Level Hi, and Probe Level Lo.

SENSOR_VALUE: Sensor Value is the physical value of the sensor (distance).

SENSOR_UNIT: Unit of measurement for sensor parameters.

SENSOR_OFFSET: Distance from the sensor reference point to the top of the tank in sensor units.

CAL_TYPE: Defines type of calibration. Dry indicates that sensor value has no influence on the level calibration.

SENSOR_CAL_LO (CAL_POINT_LO): Sensor Cal Lo is the lower calibrated point of Sensor Value in sensor units.

It refers to Probe Level Lo.

SENSOR_CAL_HI (CAL_POINT_HI): Sensor Cal Hi is the upper calibrated point of Sensor Value in sensor units. It refers to Probe Level Hi.

PROBE_LEVEL_LO (LEVEL_LO): Probe Level Low is the value of Probe Level at Sensor Cal Lo and is defined in Probe Level units.

PROBE_LEVEL_HI (LEVEL_HI): Probe Level Hi is the value of Probe Level at Sensor Cal Hi and is defined in Probe Level units.

LEVEL_OFFSET: Desired level reading when liquid surface is at end of probe. Level Offset is defined in Probe Level units.

LIN_TYPE: Type of linearization. No linearization is supported.

SENSOR_HIGH_LIMIT: Upper process limit of the sensor in sensor units.

SENSOR_LOW_LIMIT: Lower process limit of the sensor in sensor units.

Another important parameter found later in the **TRANSDUCER** block list is **DEVICE_STATUS**, which displays the status of the device. If more than one message exists, then the messages are displayed in priority order. Refer to Section 7.1.2, Error Messages.

If **DEVICE_STATUS** indicates a problem, refer to Section 7.1, Troubleshooting.

For a complete list of Transducer Block Parameters, refer to table in the Appendix.

4.3.2 Password Parameters

To change a parameter at the local user interface, a value matching the user password must be entered (Default=0). If the user password is entered, the instrument is in the user mode. After 5 minutes with no keypad activity, the entered password expires.

Factory password is for use by trained factory personnel only.

From the network, the instrument always behaves as if it is in the user mode by default. In other words, it is not necessary to enter the user password in order to write parameters from the network.

4.3.3 Eclipse Model 705 Configuration Parameters

This set of parameters within the Transducer Block is important and required to configure every Eclipse Model 705 transmitter.

PROBE_MODEL: Select the choice that corresponds to the first four digits of the model number of the probe. An “x” in the selection means that character is variable (the probe model number is shown on the nameplates attached to both the transmitter and probe). For example, 7xA-x should be chosen for probe models beginning with 7EA or 7MA.

PROBE_MOUNT: Select the type of mounting on the probe. The choices are NPT, BSP, and Flange.

MEASUREMENT_TYPE: Select from LEVEL ONLY, LEVEL AND VOLUME, INTERFACE, or INTERFACE AND VOLUME.

PROBE_LENGTH: Enter the exact length of the probe. The probe length is shown as the last three digits of the probe model number printed on the nameplates attached to the transmitter and probe. PROBE_LENGTH is shown in SENSOR_UNITS.

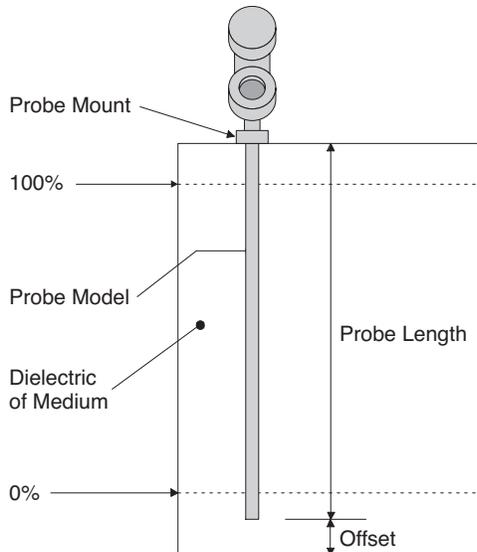
LEVEL_OFFSET: Enter the distance from the probe tip to the desired 0% reference in PROBE_LEVEL_UNITS. The acceptable range is from -300 inches to 600 inches. Refer to Section 4.3.4 for additional information.

DIELECTRIC_RANGE: Select from 10–100, 3–10, 1.7–3.0, or 1.7–1.4

NOTE: All dielectric ranges are not available with all probes.

If an unsupported dielectric range is selected, the transmitter will give a negative response and the value displayed will revert to its previous value.

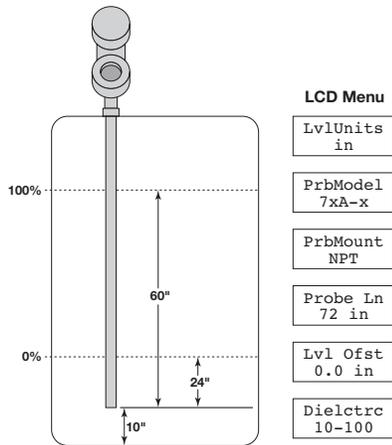
THRESHOLD: The threshold can be set as either FIXED or CFD. The factory default is CFD. This parameter should only be changed to FIXED in those applications measuring total level having a lower dielectric material over a higher dielectric material. A typical example for FIXED Threshold is a hydrocarbon application having water bottoms.



4.3.4 Offset Description

The parameter referred to as LEVEL_OFFSET in the Transducer Block is the desired level reading when liquid surface is at the end of the probe. The Eclipse transmitter is shipped from the factory with LEVEL_OFFSET set to 0. With this configuration, all measurements are referenced from the bottom of the probe. See Example 1.

Example 1 (LEVEL_OFFSET = 0 as shipped from factory):
Application calls for a 72-inch NPT Coaxial probe in water with the bottom of the probe 10 inches above the bottom of the tank. The user wants the 0% point at 24 inches and the 100% point at 60 inches as referenced from the bottom of the probe.

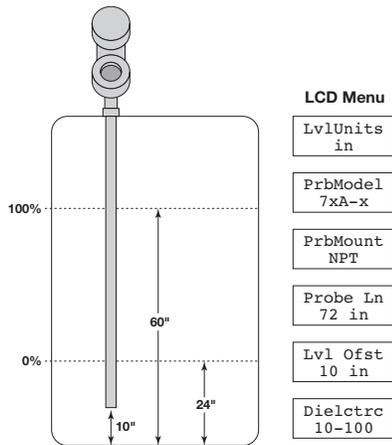


Example 1

In those applications in which it is desired to reference all measurements from the bottom of the vessel, the value of LEVEL_OFFSET should be changed to the distance between the bottom of the probe and the bottom of the vessel as shown in Example 2.

Example 2:

Application calls for a 72-inch NPT coaxial probe in water with the bottom of the probe 10 inches above the bottom of the tank. The user wants the 0% point at 24 inches and the 100% point at 60 inches as referenced from the bottom of the tank.

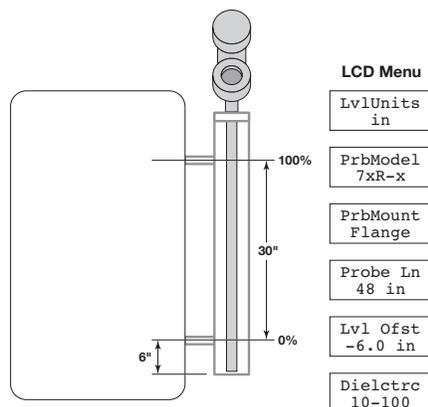


Example 2

When the Eclipse transmitter is mounted in a chamber/bridle, it is usually desirable to configure the unit with the 0% point at the lower process connection and the 100% point at the upper process connection. The span is the center-to-center dimension. In this case, a negative LEVEL_OFFSET needs to be entered. In doing so, all measurements are then referenced at a point up on the probe as shown in Example 3.

Example 3:

Application calls for a 48-inch cage-coaxial flanged probe measuring water in a chamber with the bottom of the probe 6 inches below the lower process connection. The user wants the 0% point to be 0 inches at the bottom process connection and the 100% point to be 30 inches at the top process connection.



Example 3

4.4 User-Calibration Parameters

One of the main advantages of the Enhanced Eclipse Model 705 transmitter is that the device does not need to be calibrated in the field. Every Enhanced Eclipse Model 705 transmitter is shipped from the factory precisely calibrated.

Part of the advantage of PROFIBUS PA™ is to provide the ability to monitor changes and make adjustments to a transmitter. The fieldbus concept allows a user to make calibration adjustments if deemed necessary.

NOTE: The original factory calibration settings are restored when a new probe length value is assigned.

It is highly recommended that factory calibration be used for optimum performance.

Contact the factory for information on how to perform a User Calibration.

4.4.1 Factory Parameters

The following parameters are used for either troubleshooting or are parameters adjusted at the factory. They should never be changed in the field.

The factory-adjustable calibrated parameters are WINDOW, CONVERSION_FACTOR, and SCALE_OFFSET.

WINDOW is used to adjust for the variations in the analog section of the Eclipse TDR measurement engine. CONVERSION_FACTOR and SCALE_OFFSET are the main factory calibration settings.

WINDOW: determines the amount of delay between the generation of the transmitted signal pulse and the start of the measurement cycle.

FID_TICKS: a measure of the time to the fiducial (reference) pulse.

LEVEL_TICKS: a measure of the time to the level of the product being measured.

CONVERSION_FACTOR: the slope of the factory-set calibration line.

SCALE_OFFSET: the intercept of the calibration line.

4.4.2 Firmware Version

The last parameter in the TRANSDUCER block gives the firmware version of the transmitter.

FIRMWARE_VERSION: displays the version of the firmware.

4.5 Analog Input Block

The ANALOG INPUT (AI) block takes the Transducer Block input data, selected by channel number, and makes it available to other function blocks at its output:

1. Level
2. Volume
3. Interface
4. Interface Volume

4.5.1 AI Block Parameters

The first eight parameters in an AI block are the standard block parameters discussed in section 4.1.1. Additional analog input function block parameters are as follows:

BATCH: A parameter intended to be used in Batch application in line with IEC 61512 Part 1.

OUT: Contains the current measurement value in the configuration engineering unit.

PV_SCALE: High and low scale values used to convert Process Variable Configured by channel into percent.

OUT_SCALE: The high and low scale values, the engineering code, and number of digits to the right of the decimal point to be used in displaying the OUT parameters.

LIN_TYPE: Type of linearization. No linearization is supported in the AI function blocks.

CHANNEL: Selects the measurement value from an active transducer block as the input to the function block.

PV_FTIME: Filter time of the Process Variable.

FSAFE_TYPE: Defines the reaction of a device, if a fault is detected and the quality of the process variable input from the transducer block is BAD.

0 = FSAFE_VALUE is used as OUT

1 = Use last stored valid OUT value

2 = OUT has incorrect calculated value; status remains "bad".

FSAFE_VALUE: Default value for the OUT parameter, if a fault is detected, and FSAFE_TYPE is 0.

HI_LIM: Value of the upper limit of warnings.

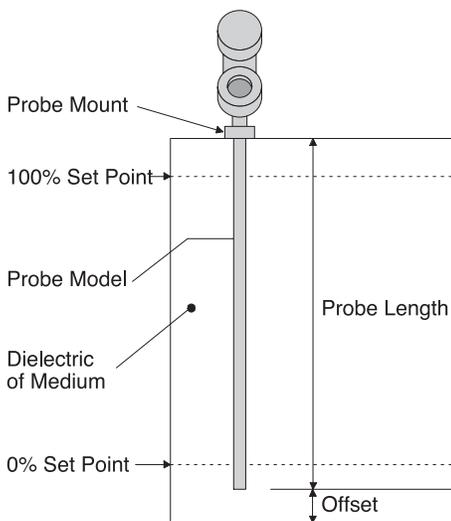
LO_LIM: Value of the lower limit of warnings.

ALARM_HYS: Hysteresis to adjust sensitivity of alarm triggering.

HI_HI_LIM: Value of the upper limit of alarms.

HI_LIM: Value of the upper limit of warnings.

LO_LIM: Value of the lower limit of warnings.



Scaling

LO_LO_LIM: Value of the lower limit of alarms.

HI_HI_ALM: State of the upper limit of alarms.

HI_ALM: State of the upper limit of warnings.

LO_ALM: State of the lower limit of warnings.

LO_LO_ALM: State of the lower limit of alarms.

SIMULATE: For commissioning and test purposes, the input value of the Transducer Block in the AI Block can be modified.

OUT_UNIT_TEXT: Allows the user to write text if a specific unit of the OUT parameter is not in the code list.

The TRANSDUCER and AI Block's actual mode in the MODE_BLK parameter must be set to AUTO to pass the PV Value through the AI to the network.

Transducer scaling, called PV_SCALE, is applied to the PV from the CHANNEL to produce the FIELD_VAL in percent. Units of PV_SCALE are the same as the units of the TRANSDUCER BLOCK process variable configured by channel.

Damping Filter is a feature of the AI Block. PV_FTIME parameter is the time constant of a single exponential filter for the PV, in seconds. This parameter can be used to dampen out fluctuation in level due to excessive turbulence.

The AI Block has multiple ALARM functions that monitor the OUT parameter for out of bound conditions.

4.5.2 Local Display of Analog Input Block Output Values

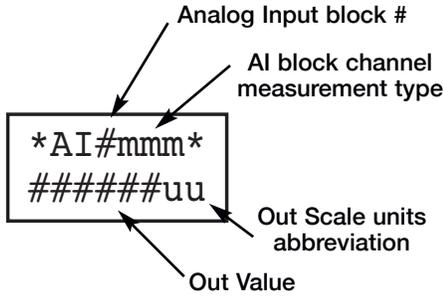
The Model 705 3x PROFIBUS PA™ [Device Revision 2] transmitter incorporates a feature that allows the device's Analog Input [AI] Block Out values to be displayed on the local LCD.

NOTE: There are many reasons that AI Block Out values can deviate from the measurement value originating in the Transducer block, and because the keypad and local display will only provide access to Transducer block parameters, there is no way to explore or change the other fieldbus configuration items affecting the AI Block output using the keypad and LCD.

These screens should only be considered as measured value indicators for configured transmitters.

- The screens are not used for commissioning or diagnostic / troubleshooting purposes.
- Prior to configuration of AI Blocks, the value displayed will not reflect the transducer measurement. (Pre-configuration values will typically be 0).

4.5.2.1 AI Out Display Screens



Analog Input Out Display

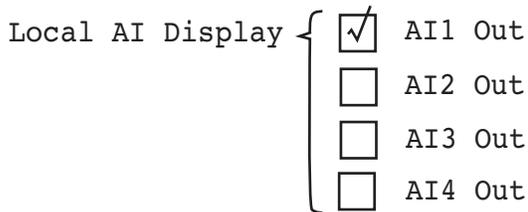
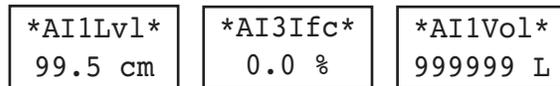
The Analog Input Out values will be conditionally displayed as part of the “rotating” home menu screens.

The screens will be formatted as shown where # in the title is the number of the AI block (1, 2, 3, or 4) and mmm is one of: “Lvl”, “Vol”, “Ifc”, “IfV”, “---” depending on the value of the associated AI block’s Channel parameter.

- For example, “AI1Lvl” would be the most commonly used AI Out screen.
- “AI2---” would be displayed when the channel value is 0 [uninitialized] for AI block 2.

The Out value will be displayed subject to limitations necessary for a 6-character display [999999 > Value > -999999].

Representative examples are shown below:



Because the Model 705 transmitter has four Analog Input blocks any or all of which may be used in particular applications, a Transducer block parameter controls which AI block Out values will be displayed.

The fieldbus presentation of this parameter will be similar to that shown at left (host system dependent).

Any or all (or none) of the AI block Out values can be selected for display on the LCD.

The local LCD version of this parameter is shown differently due to the limitations of the LCD:

LCD label: “**AI Disp**”

The default value of the Local AI Display parameter will be such that AI 1 Out is selected.

None	AI4
AI1	AI1+AI4
AI2	AI2+AI4
AI1+AI2	AI1,2,4
AI3	AI3+AI4
AI1+AI3	AI1,3,4
AI2+AI3	AI2,3,4
AI1,2,3	All AIs

Analog Input Out Values To Be Displayed

5.0 Model 705 Menu: Step by Step Procedures

The following table describes the software menu displayed by the Eclipse PROFIBUS PA™ transmitter for “Level Only” measurement. Use this table as a step by step guide to configure the transmitter.

The second column presents the menus shown on the transmitter display. The displays are in the order they would appear if the arrow keys were used to scroll through the menu. The numbers on the first column are not shown in the display. They are only provided as reference.

The third column provides the actions to take when configuring the transmitter. Additional information or an explanation of an action is given in the fourth column. (Shaded sections are factory menu items).

	Display	Password	Action	Comment
1	*Status* *Level* *AllLvl*	None	Transmitter Display	MeasType = Lvl Only
2	Level xxx.x lu	None	Transmitter Display	All MeasType selections
3	LvlUnits (select)	User	Select the Level units	Select from cm, inches, feet, meters, percent
4	AllLvl xx.x%	None	Transmitter Display	All MeasType selections
5	PrbModel (select)	User	Select the type of probe used	Select from 7xA-x, 7xB-x, 7xD-x, 7xG-x, 7xK-x, 7xP-x, 7xQ-x, 7xR-x, 7xE-x, 7xF-x, 7xF-E, 7xF-F, 7x1-x, 7x2-x, 7x5-x, 7x7-x, 7xF-4, 7xF-P, 7xJ-x, 7xL-x, 7xM-x, 7xN-x, 7xS-x, 7xT-x
6	PrbMount (select)	User	Select the type of probe mounting	Select from NPT, BSP or Flange
7	MeasType (select)	User	Select type of measurement	Select from Lvl Only, Lvl&Vol, Intrface, lfc&Vol
8	SnsrUnit (select)	User	Select the Sensor units	Select from cm, inches, feet, meters
9	Probe Ln xxx.x su	User	Enter the exact length of the probe	11.8 to 900 in (30 to 2286 cm)
10	PrbLvlUn	User	Select Probe Level units	Select from cm, inches, feet, meters, percent
11	Lvl Ofst xxx.x plu	User	Enter desired Level reading when probe is dry	-90 to 300 in (-228.6 to 762 cm)
12	Dielctrc (select)	User	Select range bounding the dielectric constant of the medium	Select from 1.4-1.7, 1.7-3, 3-10, 10-100
13	Senstvty xxx	Superuser or user	Adjust gain value upward or downward to sense liquid surface	(Superuser password required for dual element probes.)
14	BlockDis xx.x su	User	Enter distance below reference point where level is not sensed	-99.9 to 2286 cm (-39.3 to 900 in)
15	SftyZone (select)	User	Select behavior when level is sensed in safety zone	Off, On, Latch

	Display	Password	Action	Comment
16	SZHeight xx.x su	User	Enter distance below BlockDis where SZ Fault will be asserted	5.1 to 2286 cm (2 to 900 in)
17	SZ Latch Reset	User	Press Enter to clear a Safety Zone latch	
18	Threshld (select)	User	Select from CFD, Fixed	For interface, refers to threshold for upper level pulse
19	Trim Lvl xx.x su	Superuser or user	Enter value to adjust Level reading	-20.0 inches <= Lvl Trim <= +20.0 inches (Superuser password required if negative fiducial.)
20	Dev Addr	User	Set Device Address	0 to 126
21	AIDisp (select)	User	Select AI Block Out values to be displayed	
22	LvlTicks xxxxx	User	Diagnostic Display	Time of flight from fiducial to level signal
23	New Pass xxx	User	Enter new password (0-255)	Displays encrypted value of present password
24	Language (select)	User	Select from English, Spanish, French, German	Language choice for LCD display
25	Mdl705PA Ver 3.0A	None	Transmitter Display	Product identification Firmware version
26	DispFact (select)	None	Select Yes to display factory parameter menus	
27	History Status (status)	None	Diagnostic Display to view present status and recent exceptions	
28	Run Time xxxx.x h	None	Diagnostic Display showing elapsed time since power on	Cleared to zero with History Reset
29	History Reset	Superuser	Press Enter and select yes to clear history	Similar to SZ Mode Reset.
30	HF Cable (select)	Superuser	Select length of remote extension cable	Select Integral, 3-foot, 12-foot
31	FidTicks xxxx	None	Diagnostic Display	Time of flight from start of ramp to fiducial
32	Fid Sprd xxx	None	Diagnostic Display	Spread in fiducial ticks readings
33	Fid Type (select)	Superuser	Superuser parameter	Select from Positive, Negative. Selection only allowed for some probes, fixed for others
34	Fid Gain xxx	Superuser	Superuser parameter	
35	Window xxx	Factory	Factory Parameter	Calibration parameter
36	Conv Fct xxxx	Factory	Factory Parameter	Calibration parameter
37	Scl Ofst xxx	Factory	Factory Parameter	Calibration parameter
38	Neg Ampl xxx	Superuser	Superuser Parameter	Diagnostic parameter
39	Pos Ampl xxx	Superuser	Superuser Parameter	Diagnostic parameter
40	Signal xxx	None	Diagnostic Display	Indication of level signal amplitude

	Display	Password	Action	Comment
41	Compsate	Superuser	Superuser Parameter	Select from None, Manual, Auto
42	DrateFct xxxx	None	Diagnostic Display	Compsate = Auto, velocity derating factor
43	TargAmpl xxxx	None	Diagnostic Display	Compsate = Auto, target negative threshold amplitude
44	Targ Tks xxxx	None	Diagnostic Display	Compsate = Auto, measured time of flight from fiducial to target
45	Targ Cal xxxx	Superuser	Diagnostic Display	Compsate = Auto, calibrated time of flight from fiducial to target in room temperature air
46	OperMode (select)	Superuser	Superuser Parameter	Compsate = Auto, select from Run, Cal, Off
47	7xK Corr xxx	Superuser	Superuser Parameter	Probe Model = 7xK, Distance in mm from fiducial to user reference point
48	Snsr Val xxx.x su	None	Distance to the target relative to the sensor reference point.	
49	SnrCalLo xxx.x su	Superuser	The lower calibrated point of Sensor Value. It refers to PrLvl Lo.	In Sensor Units. Set to entered Probe Ln
50	SnrCalHi xxx.x su	Superuser	The higher calibrated point of Sensor Value. It refers to PrLvl Hi.	In Sensor Units
51	ProbeLvl xxx.x plu	None	Level on the probe relative to the end of the probe.	
52	PrLvl Lo xxx.x plu	Superuser	Value of PrLvl at SnrCalLo.	In Probe Level Units
53	PrLvl Hi xxx.x plu	Superuser	Value of PrLvl at SnrCalHi.	In Probe Level Units
54	ElecTemp xxx C	None	Diagnostic Display	Present temperature in electronics compartment (degrees Celsius)
55	Max Temp xxx C	Superuser	Diagnostic Display	Maximum electronics temperature recorded
56	Min Temp xxx C	Superuser	Diagnostic Display	Minimum electronics temperature recorded
57	SZ Hyst xx.x su	Superuser	Superuser Parameter	Safety Zone hysteresis height

6.0 Diagnostic Parameters

The Eclipse Model 705 measurement engine runs through a series of self-tests and will detect and report faulty operation. The TRANSDUCER BLOCK displays these faults in the DEVICE_STATUS parameter. Refer to Section 7.1.2 for more information on specific faults and warnings.

When the Model 705 transmitter is initially powered on, the measurement engine does not have enough valid measurement cycles to make a decision about the output level. For the first sixteen measurement cycles after power is applied, the QUALITY is “Uncertain,” the SUB_STATUS is “Initial value,” and the LIMIT attribute is “Constant.”

When the Model 705 is operating correctly, the QUALITY is shown as “GOOD,” and the SUB_STATUS is “Non-Specific.”

Depending on the FAIL SAFE MODE in AI BLOCK, when the Enhanced Model 705 measurement cycle fails to find a valid output level, the transmitter maintains the last good value as the output and flags the failure. The LIMIT attribute is the same as the last good measurement. Excessive disrupted cycles causes the transmitter to go into a defined operational mode based on the cause of the disrupted cycles.

When the Enhanced Model 705 detects a level above the highest measurement point of the probe the operational mode is shown as “May Be Flooded.” This is due to the fact that since the actual level location above the top of some probes is not known, the output may not be accurate.

The Model 705 operational mode is DRY_PROBE when the level is below the end of the probe. Again, the output may not be accurate, since the location of the level below the end of the probe is not known. The TRANSDUCER BLOCK output is calculated as LEVEL_OFFSET.

When in the dry probe condition, the Model 705 compares the measured length of the probe to the value entered into the PROBE_LENGTH parameter. If the measured value does not match PROBE_LENGTH, a fault is reported. The QUALITY will be shown as “Bad,” and the SUB_STATUS is “Configuration error.”

If the Model 705 fails to find a measurable level, either due to an actual loss of a level signal or the loss of a proper Fiducial (reference) signal, the TRANSDUCER BLOCK maintains the last good value as the output and flags the failure. The QUALITY is “Bad,” the SUB_STATUS is “Sensor failure” for no level (or “Device failure” for loss of the Fiducial), and the LIMIT attribute is “Constant.”

Device status conditions and the effects on PV Status are summarized in section 7.1.2.

6.1 Simulation Feature

The Eclipse Model 705 with PROFIBUS PA™ supports the Simulate feature in the Analog Input Block. The Simulate feature is typically used to exercise the operation of an AI block by simulating a TRANSDUCER block input.

When an Analog Input Block is in Manual Mode, the operator can also set the value and status of the OUT parameter to simulate different AI BLOCK outputs.

7.0 Reference Information

7.1 Troubleshooting

WARNING!

Explosion hazard. Do not connect or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

The Eclipse transmitter is designed and engineered for trouble-free operation over a wide range of operating conditions. Common transmitter problems are discussed in terms of their symptoms and recommended corrective actions. Information on how to handle material buildup on the probe is also provided in this section.

7.1.1 Troubleshooting System Problems

Symptom	Problem	Solution
LEVEL and % OUTPUT values are inaccurate.	Basic configuration data is questionable.	Reconfigure the Probe Model and/or Probe Mount, Probe Length or Level Offset. 1) Ensure the Level is accurate.
	Interface level has significant emulsion.	Examine process to reduce/eliminate emulsion layer.
LEVEL readings are repeatable but consistently high or low from actual by a fixed amount.	Configuration data does not accurately match probe length or tank height.	Ensure proper Probe Model, Level Offset & probe length. Adjust trim level value by the amount of noted inaccuracy.
LEVEL and % OUTPUT values fluctuate.	Turbulence	Increase the Damping factor until the readings stabilize.
	High Frequency connection	Check Fid Spread (should be stable within ± 10 counts).
LEVEL and % OUTPUT values all reading low vs. actual.	Lower dielectric material over higher dielectric material, e.g., oil over water	Select Fixed Threshold option.
	Coating, clumping or buildup on probe	These may be expected inaccuracies due to affect on pulse propagation.
	Dense, water based foam	These may be expected inaccuracies due to affect on pulse propagation.
Level Reading on Display is stuck at full scale.	Software believes probe is flooded (level near very top of probe).	Check actual level. If probe is not flooded, Check for buildup or obstructions near top of probe. Select higher dielectric range. Check for condensation in probe connection. Add Blocking Distance.
LEVEL and % OUTPUT values values all at maximum level.	Possible configuration issue with single rod probe	1) Increase Blocking Distance 2) Increase Dielectric Range
LEVEL and % OUTPUT values reading high vs. actual.	Possible obstruction in tank affecting single rod probe	1) Increase Dielectric Range until obstruction is ignored 2) Relocate probe away from obstruction
LEVEL value reading high when should be zero.	Transmitter loose or disconnected from probe	Ensure transmitter connected securely to probe.

NOTE: When consulting the factory concerning improper operation, use proper tables on Pages 50-51. Enter all data when transmitter is working CORRECTLY and INCORRECTLY.

7.1.2 Device Status Parameter in the Transducer Block

The following table lists the conditions indicated in the Device Status parameter. It also shows the affect the condition has on PV status, Sub-Status and Limit.

Device Status				PV Status	PV Sub Status	Limit
Type	Label	Bit #	Value	Quality		
Mode	OK	15	0x00008000	Good	Non-Specific	Not Limited
Fault	Default Params	28	0x10000000	Bad	Configuration Error	Not Limited
Fault	No End of Ramp	27	0x08000000	Bad	Device Failure	Constant Limited
Fault	Lvl<Probe Length	23	0x00800000	Bad	Sensor Failure	Constant Limited
Fault	No Fiducial	21	0x00200000	Bad	Device Failure	Constant Limited
Fault	Safety Zone FLT	20	0x00100000	Bad	Non-Specific	Not Limited
Fault	No Signal	19	0x00080000	Bad	Sensor Failure	Constant Limited
Fault	EOP<Probe Length	18	0x00040000	Bad	Sensor Failure	Constant Limited
Fault	EOP High	17	0x00020000	Bad	Configuration Error	Not Limited
Fault	High Volume Fit	16	0x00010000	Bad	Configuration Error	High Limited
Warning	Hi Temperature	11	0x00000800	No Effect	No Effect	No Effect
Warning	Lo Temperature	10	0x00000400	No Effect	No Effect	No Effect
Warning	Default Cal	9	0x00000200	No Effect	No Effect	No Effect
Warning	Initializing	4	0x00000010	Uncertain	Initial Value	Constant Limited
Warning	May be Flooded	3	0x00000008	No Effect	No Effect	High Limited
Warning	Dry Probe	2	0x00000004	No Effect	No Effect	Low Limited
Warning	Weak Signal	1	0x00000002	No Effect	No Effect	No Effect
Warning	No Steam Target	6	0x00000040	No Effect	No Effect	No Effect

The first condition is Type Mode. If everything is running normally and there are no Faults or Warnings, then the device indicates it is “OK” an the local display and in Device Status.

The next set of conditions is device faults. The device will most likely not be able to measure level correctly if one or more of these conditions occur. The condition will be indicated in Device Status and will affect PV Status, Sub-Status and Limit as indicated.

The next set of conditions is the device warnings. The condition will not jeopardize the level measurement. However, knowledge of the condition may be useful in troubleshooting the device.

The following table describes the conditions that can be seen in Device Status:

Display Message	Action	Comment
OK	None	Normal operating mode.
Default Params	Internal non-volatile parameters have been defaulted.	Consult factory.
No End of Ramp	No End-of Ramp signal detected.	Consult factory.
No Fiducial	Fiducial signal is not being detected.	1) Check connection between probe and transmitter. 2) Check for moisture on top of probe. 3) Check for damaged gold pin in the high frequency connector. 4) Consult factory.

7.1.2 Device Status Parameter in the Transducer Block

Display Message	Action	Comment
Safety Zone Flt	Safety Zone Alarm has been tripped.	Decrease level in vessel.
No Signal	No level signal being detected.	1) Ensure Dielectric setting is correct for the measured medium. 2) Increase Sensitivity 3) Confirm Probe Model is proper for the dielectric of the medium. 4) Consult factory.
EOP<Probe Length	End of Probe signal from a dry probe is out of range.	1) Ensure the Probe Length is entered correctly. 2) Set Dielectric to a lower dielectric range. 3) Consult factory. 4) Ensure proper Blocking Distance.
Lvl<Probe Length	Apparent position of the upper level pulse is beyond the end of the probe.	1) Check entered Probe Length. 2) Change Threshold to Fixed.
EOP High	End of Probe signal is out of range.	1) Ensure Probe Length is entered correctly. 2) Consult factory.
High Volume Flt	Level more than 5% above highest point in strapping table.	1) Verify strapping table is entered correctly. 2) Signal amplitude may be lower than desired.
Hi Temperature	Present temperature in electronics compartment is above 80 C.	1) Transmitter may need to be moved to ensure ambient temperature is within specification. 2) Change to remote mount transmitter.
Lo Temperature	Present temperature in electronics compartment is below -40° F (-40° C).	1) Transmitter may need to be moved to ensure ambient temperature is within specification. 2) Change to remote transmitter.
Default Cal	Factory set default calibration parameters are in use. Level reading may be inaccurate.	Consult factory.
No Steam Target	No steam target detected on Model 7x5 probe.	Consult factory.
Initializing	None	Program is initializing. This is a transient condition.
May be Flooded	Loss of level signal possibly due to flooding. Twin Rod probes only.	1) Decrease level in vessel. 2) Set Dielectric to lower range value. 3) Replace with Model 7xR Overfill probe.
Dry Probe	None	Normal message for a dry probe. End of Probe signal is being detected in correct location.
Weak Signal	None. Signal amplitude is lower than desired.	1) Set Dielectric to a lower range value. 2) Increase Sensitivity.

7.1.3 Error Mapped to Diagnosis

Some error codes are mapped to information bits in the PHYSICAL_BLOCK_DIAGNOSIS parameter as shown in the following table:

Display Message	Description
No Signal Fault	Failure in Measurement
Lvl<PL Fault	Failure in Measurement
EOP<PL Fault	Failure in Measurement
No End of Ramp Fault	Electronic Hardware Failure/Maint Required
No Fiducial Fault	Electronic Hardware Failure/Maint Required
Default Parameters Fault	Configuration not valid
EOP High Fault	Configuration not valid
Hi Temperature Warning	Electronic Temperature too high

7.1.3 Error Mapped to Diagnosis (cont.)

Note that PV status for Interface and Volume process variables may indicate a configuration error if the correct Measurement Type has not been selected. In this case, “Configuration not valid” will not be set in the DIAGNOSIS parameter since level measurement may still be correct.

Also, a Default Parameters Fault is indicated after a Factory Reset which will result in the DIAGNOSIS indication “Configuration not valid”.

7.1.4 PROFIBUS PA™ Segment Checklist

There can be several reasons for a PROFIBUS PA™ installation to be in a faulty condition. In order to assure that communication can be established, the following requirements must be met.

- Device supply voltage must be higher than 9 VDC with a maximum of 32 VDC.
- Total current draw of a given segment cannot exceed the rating shown on the power conditioner and/or barrier.
- Device polarity must be correct.
- Two 100 Ω, 1 μF terminators must be connected to the network—one at each end of the segment.
- Cable length plus spur length must not exceed the following

Number of Spurs	1 Device	2 Devices	3 Devices	4 Devices
25–32	—	—	—	—
19–24	100 ft. (30 m)	—	—	—
15–18	200 ft. (60 m)	100 ft. (30 m)	—	—
13–14	300 ft. (90 m)	200 ft. (60 m)	100 ft. (30 m)	—
1–12	400 ft. (120 m)	300 ft. (90 m)	200 ft. (60 m)	100 ft. (30 m)

Pair	Shield	Twisted	Size	Length	Type
Single	Yes	Yes	AWG 18 (0.8 mm ²)	6,200 ft. (1,900 m)	A
Multi	Yes	Yes	AWG 22 (0.32 mm ²)	3,900 ft. (1,200 m)	B
Multi	No	Yes	AWG 26 (0.13 mm ²)	1,300 ft. (400 m)	C
Multi	Yes	No	AWG 16 (1.25 mm ²)	650 ft. (200 m)	D

values:

- The cable shield is to be hard grounded only at one point close to the DCS. In addition, the cable shield can be capacitively grounded in multiple places to improve EMC protection.

If all of these requirements are met, a stable communication should be established.

7.2 Agency Approvals

AGENCY	MODEL APPROVED	APPROVAL CATEGORY	APPROVAL CLASSES
FM 	705-53XX-1XX 705-53XX-2XX	Intrinsically Safe	Class I, Div. 1; Groups A, B, C, & D Class II, Div. 1; Groups E, F, & G T4 Class III, Type 4X IP66 Entity/FISCO
	705-53XX-3XX 705-53XXX-4XX	Explosion Proof ① (with Intrinsically Safe probe)	Class I, Div. 1; Groups B, C & D Class II, Div. 1; Groups E, F, & G T4 Class III, Type 4X IP66
	705-53XX-XXX 705-53XX-XXX	Non-Incendive Suitable for: ②	Class I, Div. 2; Groups A, B, C, & D Class II, Div. 2; Groups F & G T4 Class III, Type 4X IP66
CSA 	705-53XX-1XX 705-53XX-2XX	Intrinsically Safe	Class I, Div. 1; Groups A, B, C, & D Class II, Div. 1; Group G T4 Class III, Type 4X Entity/FISCO
	705-53XX-3XX 705-53XX-4XX	Explosion Proof ① (with Intrinsically Safe probe)	Class I, Div. 1; Groups B, C & D Class II, Div. 1; Group G T4 Class III, Type 4X
	705-53XX-XXX 705-53XX-XXX	Non-Incendive Suitable for: ②	Class I, Div. 2; Groups A, B, C, & D Class II, Div. 2; Group G T4 Class III, Type 4X
ATEX 	705-53XX-AXX 705-53XX-BXX	Intrinsically Safe	Ⓜ II 1G, EEx ia IIC T4
	705-53XX-CXX 705-53XX-DXX	Flame Proof ①	Ⓜ II 1/2G, EEx d [ia] IIC T4
	705-53XX-EXX 705-53XX-FXX	Non-sparking ②	Ⓜ II 3G, EEx n II T4..T6

① Factory Sealed: This product has been approved by Factory Mutual Research (FM), and Canadian Standards Association (CSA), as a Factory Sealed device.

② Measured media inside vessel must be non-flammable only.



These units are in conformity of:

1. The EMC Directive: 89/336/EEC. The units have been tested to EN 61000-6-2/2001 and EN 61000-6-4/2001.
2. Directive 94/9/EC for equipment or protective system for use in potentially explosive atmospheres.

7.3 Specifications

7.3.1 Functional

System Design

Measurement Principle Guided time-of-flight via time domain reflectometry

Input

Measured Variable Level, determined by the time-of-flight of a guided radar pulse from transmitter to product surface and back

Zero and Span 6 inches to 75 feet (15 to 2286 cm)

User Interface

Keypad 3-button menu-driven data entry and system security

Indication 2-line × 8-character display

Digital Communication PROFIBUS PA™ Profile Version 3.0, MBP (31.25 kbits/sec)

Minimum Operating Voltage 9 VDC

Quiescent Current Draw 15 mA

DEV Revision 0X01

Function Blocks AI_1, AI_2, AI_3, AI_4

Damping Adjustable 0-10 seconds

Power (Measured at instrument terminals)

General Purpose/Explosion Proof 9 to 32 VDC (15 mA maximum current draw)

IS/FISCO/FNICO 9–32 VDC (15 mA maximum current draw)

Housing

Material Aluminum A356T6 (<0.20% copper), optional 316 stainless steel

Cable Entry ¾" NPT and M20

Environment

Operating Temperature -40 to +175° F (-40 to +80° C)

Display Function Operating Temperature -5 to +160° F (-20 to +70° C)

Storage Temperature -50 to +175° F (-40 to +80° C)

Humidity 0-99%, non-condensing

Electromagnetic Compatibility Meets CE Requirements: EN 50081-2, EN 50082-2

Note: Twin Rod and Single Rod probes must be used in metallic vessel or stillwell to maintain CE requirement.

Mounting Affects: Twin Rod: Active rod must be mounted at least 1" (25 mm) from any surface or obstruction. Minimum stillwell diameter for Twin Rod probe is 3".

Single Rod: Nozzles do not restrict performance by ensuring the following:

No nozzle is <2" (50 mm) diameter

Ratio of Diameter: Length is 1:1 or greater;

any ratio <1:1 (e.g., a 2" × 6" nozzle = 1:3) may require a Blocking Distance and/or DIELECTRIC adjustment

No pipe reducers are used

Obstructions

Keep conductive objects away from probe to ensure proper performance

Shock Class ANSI/ISA-S71.03 Class SA1

Vibration Class ANSI/ISA-S71.03 Class VC2

7.3.2 Performance - Model 705

Reference Conditions ①	Reflection from water at +70° F (+20° C) with 72" coaxial probe (CFD threshold)
Linearity ②	Coaxial/Twin Rod Probes: <0.1% of probe length or 0.1 inch (whichever is greater)
	Single Rod Probes: <0.3% of probe length or 0.3 inch (whichever is greater)
Measured Error ③	Coaxial/Twin Rod Probes: ±0.1% probe length or 0.1 inch (whichever is greater)
	Single Rod Probes ±0.5% probe length or 0.5 inch (whichever is greater)
Resolution	±0.1 inch
Repeatability	<0.1 inch
Hysteresis	<0.1 inch
Response Time	<1 second
Warm-up Time	<5 seconds
Operating Temp. Range	-40° to +175° F (-40° to +80° C)
LCD Temp. Range	-5° to +160° F (-20° to +70° C)
Ambient Temp. Effect	Approximately +0.02% of probe length/ ° C
Process Dielectric Effect	<0.3 inch within selected range
Humidity	0-99%, non-condensing
Electromagnetic Compatibility	Meets CE requirements (EN-61000-6-2/2001, 61000-6-4/2001) (Twin and Single Rod probes must be used in metallic vessel or stillwell to maintain CE requirement)

① Specifications will degrade with Model 7xB, 7xD, and 7xP probes and/or Fixed threshold configuration.

② Top 24 inches of Model 7xB probe: 1.2 inches (30 mm). Specification for top 48 inches of single rod will be application dependent.

③ Accuracy may degrade when using manual or automatic compensation.

7.3.3 Performance - Model 705 Interface

Reference Conditions	Reflection from liquid of selected dielectric at +70° F (+20° C) with 72" probe
Linearity	<0.5 inch
Measured Error	Upper layer ±1 inch Interface layer ±1 inch (clean distinct interface required)
Upper Layer Dielectric	1.4–5.0
Interface Layer Dielectric	>15
Resolution	±0.1 inch
Repeatability	<0.5 inch
Hysteresis	<0.5 inch
Response Time	<1 second
Warm-up Time	<5 seconds
Operating Temp. Range	-40° to +175° F (-40° to +80° C)
LCD Temp. Range	-5° to +160° F (-20° to +70° C)
Ambient Temp. Effect	Approximately ±0.02% of probe length/ ° C
Humidity	0-99%, non-condensing
Electromagnetic Compatibility	Meets CE requirements (EN-61000-6-2/2001, EN 61000-6-4/2001)

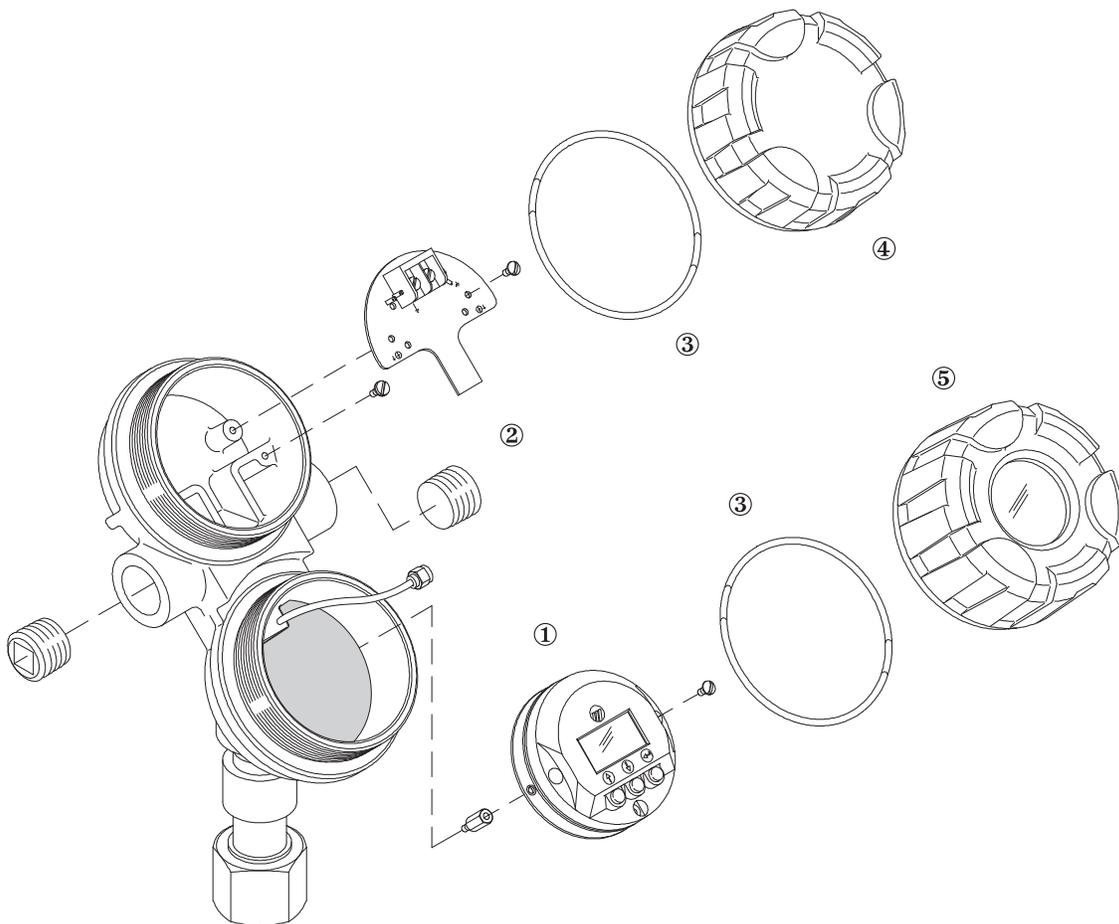
7.4 Parts

7.4.1 Replacement Parts

Item	Description	Part Number
①	Electronic module PROFIBUS PA™	Z31-2846-001
②	Terminal board PROFIBUS PA™	Z30-9151-003
③	O-ring (VITON) (Consult Factory for alternative O-ring materials)	012-2201-237
④	Housing cover without glass	004-9193-003
⑤	Housing cover with glass (GP, IS) (XP)	036-4410-001 036-4410-003

7.4.2 Recommended Spare Parts

Item	Description	Part Number
①	Electronic module PROFIBUS PA™	Z31-2846-001
②	Terminal board PROFIBUS PA™ (GP/XP) PROFIBUS PA™ (IS)	Z30-9151-003 Z30-9151-004



7.5.2 Probe

BASIC MODEL NUMBER

7E	Eclipse GWR probe, English unit of measure
7M	Eclipse GWR probe, Metric unit of measure

CONFIGURATION/STYLE

A	Coaxial, 3/4" process connection or larger	(Dielectric range ≥1.4)
B	Twin Rod, 2" NPT or 3" flanged process connection or larger	(Dielectric range ≥1.9)
D	Coaxial, High Temperature/High Pressure, 3/4" process conn. or larger	(Dielectric range ≥1.4)
F	Single Rod, Rigid, 2" process connection or larger	(Dielectric range ≥1.9)
J	Single Rod, Rigid, High Temperature/High Pressure	(Dielectric range ≥ 1.9)
P	Coaxial, High Pressure, 3/4" process connection or larger	(Dielectric range ≥1.4)
Q	Coaxial, Hot Water/Steam, 2" process connection or larger	(Dielectric range ≥10)
R	Coaxial, Overfill, 3/4" process connection or larger	(Dielectric range ≥1.4)
S	Coaxial, Hot Water/Steam, 3/4" process connection or larger	(Dielectric range ≥10)
1	Single Rod, Flexible, 2" process connection or larger	(Dielectric range ≥1.9)
2	Single Rod, Flexible Bulk Solid, 2" process connection or larger	(Dielectric range ≥4.0)
5	Twin Rod, Flexible Bulk Solid, 2" process connection or larger	(Dielectric range ≥1.9)
7	Twin Rod Flexible, 2" NPT or 3" flanged process connection or larger	(Dielectric range 1.9–10)

MATERIAL OF CONSTRUCTION

A	316/316L stainless steel
B	Hastelloy C, Configuration/Style codes A, B, D, F, G, P, R and T only
C	Monel, Configuration/Style codes A, B, D, F, G, P, R and T only
E	Hygienic, 316/316L stainless steel (20 R _a finish), Configuration/Style code F only, Process connections codes 4P, 5P, and 6P only
F	PFA faced flange, 2" to 4", 150# to 300#, Configuration/Style code F only, Process connection codes 43, 44, 53, 54, 63, 64, DA, DB, EA, EB, FA, and FB only
K	316/316L stainless steel probe and process connection, ASME B31.1 specifications (model 7xS only)
P	Paint Probe, 316/316L SS, 3/4" process connection or larger Configuration/Style code F only: maximum length 72"
4	PFA insulated rod, 2" NPT process connection or larger, Configuration/Style code F only

PROCESS CONNECTION SIZE/TYPE

Refer to pages 47 and 48 for selections

O-RINGS

0	Viton® GFLT
1	EPDM (Ethylene Propylene Rubber)
2	Kalrez 4079
8	Aegis PF128
N	None (Use with probes 7xD, 7xP, 7xF-E, 7xF-F, 7xF-P)

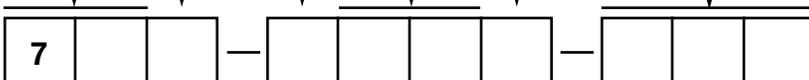
LENGTH – PROBE MODELS 7xA, 7xB, 7xD, 7xF, 7xJ, 7xP, 7xQ, 7xR & 7xS

24" to 240" (60 cm to 610 cm) (7xQ and 7xS: 180" (457 cm) maximum)
(unit of measure is determined by second digit of Model Number)

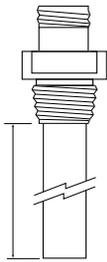
Examples: 24 inches = 024; 60 centimeters = 060

LENGTH – PROBE MODEL 7x1, 7x2, 7x5 & 7x7

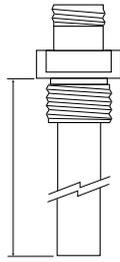
6' to 75' (2 to 22 m) (unit of measure is determined by second digit of Model Number) Examples: 30 feet = 030; 10 meters = 010



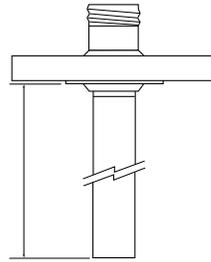
7.5.2 Probe



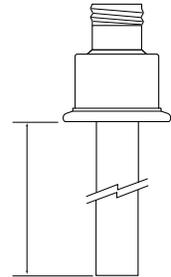
Insertion Length
NPT Process Connection



Insertion Length
BSP Process Connection



Insertion Length
ANSI or DIN Welded Flange



Insertion Length
Hygienic Flange

PROCESS CONNECTION SIZE/TYPE THREADED CONNECTIONS

11	¾" NPT Thread ①
22	1" BSP Thread ①
41	2" NPT Thread ③
42	2" BSP Thread ③

ANSI RAISED FACE FLANGE CONNECTIONS

23	1" 150#	ANSI Raised Face Flange ①	48	2" 2500#	ANSI Raised Face Flange ②
24	1" 300#	ANSI Raised Face Flange ①	53	3" 150#	ANSI Raised Face Flange
25	1" 600#	ANSI Raised Face Flange ②	54	3" 300#	ANSI Raised Face Flange
27	1" 900/1500#	ANSI Raised Face Flange ②	55	3" 600#	ANSI Raised Face Flange ②
28	1" 2500#	ANSI Raised Face Flange ②	56	3" 900#	ANSI Raised Face Flange ②
33	1½" 150#	ANSI Raised Face Flange ①	57	3" 1500#	ANSI Raised Face Flange ②
34	1½" 300#	ANSI Raised Face Flange ①	58	3" 2500#	ANSI Raised Face Flange ②
35	1½" 600#	ANSI Raised Face Flange ②	63	4" 150#	ANSI Raised Face Flange
37	1½" 900/1500#	ANSI Raised Face Flange ②	64	4" 300#	ANSI Raised Face Flange
38	1½" 2500#	ANSI Raised Face Flange ②	65	4" 600#	ANSI Raised Face Flange ②
43	2" 150#	ANSI Raised Face Flange ①	66	4" 900#	ANSI Raised Face Flange ②
44	2" 300#	ANSI Raised Face Flange ①	67	4" 1500#	ANSI Raised Face Flange ②
45	2" 600#	ANSI Raised Face Flange ②	68	4" 2500#	ANSI Raised Face Flange ②
47	2" 900/1500#	ANSI Raised Face Flange ②			

ANSI RING JOINT FLANGE CONNECTIONS

3K	1½" 600#	ANSI Ring Joint Flange ②	5L	3" 900#	ANSI Ring Joint Flange ②
3M	1½" 900/1500#	ANSI Ring Joint Flange ②	5M	3" 1500#	ANSI Ring Joint Flange ②
3N	1½" 2500#	ANSI Ring Joint Flange ②	5N	3" 2500#	ANSI Ring Joint Flange ②
4K	2" 600#	ANSI Ring Joint Flange ②	6K	4" 600#	ANSI Ring Joint Flange ②
4M	2" 900/1500#	ANSI Ring Joint Flange ②	6L	4" 900#	ANSI Ring Joint Flange ②
4N	2" 2500#	ANSI Ring Joint Flange ②	6M	4" 1500#	ANSI Ring Joint Flange ②
5K	3" 600#	ANSI Ring Joint Flange ②	6N	4" 2500#	ANSI Ring Joint Flange ②

- ① Configuration/Style Codes A, D, P, R & S only.
- ② Configuration/Style Codes D & P only.
- ③ Configuration/Style Codes B, F, 1, 2, 5 & 7 only.



7.5.2 Probe

HYGIENIC FLANGE CONNECTIONS

2P	¾" Tri-clover® type, 16 AMP Hygienic Flange
3P	1½" Tri-clover type, 16 AMP Hygienic Flange
4P	2" Tri-clover type, 16 AMP Hygienic Flange
5P	3" Tri-clover type, 16 AMP Hygienic Flange
6P	4" Tri-clover type, 16 AMP Hygienic Flange
9P	2½" Tri-clover type, 16 AMP Hygienic Flange

PROPRIETARY AND SPECIALTY FLANGE CONNECTIONS

TT	3½" 600#	Fisher® - Proprietary Carbon Steel (249B) Torque Tube Flange
TU	3½" 600#	Fisher - Proprietary 316 Stainless Steel (249C) Torque Tube Flange
UT	2½" 600#	Masoneilan® - Proprietary Carbon Steel Torque Tube Flange
UU	2½" 600#	Masoneilan - Proprietary 316 Stainless Steel Torque Tube Flange

DIN FLANGE CONNECTIONS

BA	DN 25, PN 16	DIN 2527 Form B Flange ①	DG	DN 50, PN 250	DIN 2527 Form E Flange ②
BB	DN 25, PN 25/40	DIN 2527 Form B Flange ①	DH	DN 50, PN 320	DIN 2527 Form E Flange ②
BC	DN 25, PN 64/100	DIN 2527 Form E Flange ②	DJ	DN 50, PN 400	DIN 2527 Form E Flange ②
BF	DN 25, PN 160	DIN 2527 Form E Flange ②	EA	DN 80, PN 16	DIN 2527 Form B Flange
BG	DN 25, PN 250	DIN 2527 Form E Flange ②	EB	DN 80, PN 25/40	DIN 2527 Form B Flange
BH	DN 25, PN 320	DIN 2527 Form E Flange ②	ED	DN 80, PN 64	DIN 2527 Form E Flange ②
BJ	DN 25, PN 400	DIN 2527 Form E Flange ②	EE	DN 80, PN 100	DIN 2527 Form E Flange ②
CA	DN 40, PN 16	DIN 2527 Form B Flange ①	EF	DN 80, PN 160	DIN 2527 Form E Flange ②
CB	DN 40, PN 25/40	DIN 2527 Form B Flange ①	EG	DN 80, PN 250	DIN 2527 Form E Flange ②
CC	DN 40, PN 64/100	DIN 2527 Form E Flange ②	EH	DN 80, PN 320	DIN 2527 Form E Flange ②
CF	DN 40, PN 160	DIN 2527 Form E Flange ②	EJ	DN 80, PN 400	DIN 2527 Form E Flange ②
CG	DN 40, PN 250	DIN 2527 Form E Flange ②	FA	DN 100, PN 16	DIN 2527 Form B Flange
CH	DN 40, PN 320	DIN 2527 Form E Flange ②	FB	DN 100, PN 25/40	DIN 2527 Form B Flange
CJ	DN 40, PN 400	DIN 2527 Form E Flange ②	FD	DN 100, PN 64	DIN 2527 Form E Flange ②
DA	DN 50, PN 16	DIN 2527 Form B Flange	FE	DN 100, PN 100	DIN 2527 Form E Flange ②
DB	DN 50, PN 25/40	DIN 2527 Form B Flange	FF	DN 100, PN 160	DIN 2527 Form E Flange ②
DD	DN 50, PN 64	DIN 2527 Form E Flange ②	FG	DN 100, PN 250	DIN 2527 Form E Flange ②
DE	DN 50, PN 100	DIN 2527 Form E Flange ②	FH	DN 100, PN 320	DIN 2527 Form E Flange ②
DF	DN 50, PN 160	DIN 2527 Form E Flange ②	FJ	DN 100, PN 400	DIN 2527 Form E Flange ②

- ① Configuration/Style Codes A, D, P, R & S only.
 ② Configuration/Style Codes D & P only.



7.6 References

1. "PROFIBUS™, A Pocket Guide" by Ronald W. Mitchell
2. PNO Specification 3.042, "Profile for Process Control Devices"
3. PNO Specification 2.092, "PROFIBUS PA - User and Installation Guideline"

Appendix – Transducer Block Parameters

INDEX	PARAMETER NAME	PARAMETER LABEL
0	BLOCK_OBJECT	BLOCK OBJECT
1	ST_REV	ST REV
2	TAG_DESC	TAG DESC
3	STRATEGY	STRATEGY
4	ALERT_KEY	ALERT KEY
5	TARGET_MODE	TARGET MODE
6	MODE_BLK (Act, Perm, Norm)	MODE BLK
7	ALARM_SUM	ALARM SUM
8	LEVEL	Level
9	LEVEL_UNIT	Level Unit
10	PROBE_LEVEL	Probe Level
11	PROBE_LEVEL_UNIT	Probe Level Unit
12	SENSOR_VALUE	Sensor Value
13	SENSOR_UNIT	Sensor Unit
18	SENSOR_OFFSET	Sensor Offset
19	CAL_TYPE	Calibration Type
20	CAL_POINT_LO	Sensor Cal Lo
21	CAL_POINT_HI	Sensor Cal Hi
22	PROBE_LEVEL_LO	Probe Level Lo
23	PROBE_LEVEL_HI	Probe Level Hi
24	LEVEL_OFFSET	Level Offset
25	LIN_TYPE	Lin Type
28	SENSOR_HIGH_LIMIT	Sensor High Limit
29	SENSOR_LOW_LIMIT	Sensor Low Limit
53	PROBE_MODEL	Probe Model
54	PROBE_MOUNT	Probe Mount
55	MEASUREMENT_TYPE	Measurement Type
56	PROBE_LENGTH	Probe Length
57	DIELECTRIC_RANGE	Dielectric Range
58	SENSITIVITY	Sensitivity
59	BLOCKING_DISTANCE	Blocking Distance
60	SAFETY_ZONE_MODE	Safety Zone Mode
61	SAFETY_ZONE_HEIGHT	SZ Height
62	SZ_LATCH_RESET	SZ Latch Reset
63	THRESHOLD	Threshold
64	TRIM_LEVEL	Trim Level
65	VOLUME	Volume
66	VOLUME_UNIT	Volume Unit
67	INTERFACE	Ifc Level
68	INTERFACE_UNIT	Ifc Level Unit
69	UPPER_LIQUID_DIELECT	Upper Dielectric
70	INTERFACE_THRESHOLD	Interface Threshold
71	INTERFACE_VOLUME	Ifc Volume
72	INTERFACE_VOL_UNIT	Ifc Volume Unit
73	STRAP_TABLE_LENGTH	Strapping Table Length
74	TABLE_VOLUME_UNIT	Table Volume Unit
75	STRAPPING_TABLE_PT01	StrappingTbl Pt01
76	STRAPPING_TABLE_PT02	StrappingTbl Pt02
77	STRAPPING_TABLE_PT03	StrappingTbl Pt03
78	STRAPPING_TABLE_PT04	StrappingTbl Pt04
79	STRAPPING_TABLE_PT05	StrappingTbl Pt05
80	STRAPPING_TABLE_PT06	StrappingTbl Pt06
81	STRAPPING_TABLE_PT07	StrappingTbl Pt07
82	STRAPPING_TABLE_PT08	StrappingTbl Pt08
83	STRAPPING_TABLE_PT09	StrappingTbl Pt09
84	STRAPPING_TABLE_PT10	StrappingTbl Pt10
85	STRAPPING_TABLE_PT11	StrappingTbl Pt11

INDEX	PARAMETER NAME	PARAMETER LABEL
86	STRAPPING_TABLE_PT12	StrappingTbl Pt12
87	STRAPPING_TABLE_PT13	StrappingTbl Pt13
88	STRAPPING_TABLE_PT14	StrappingTbl Pt14
89	STRAPPING_TABLE_PT15	StrappingTbl Pt15
90	STRAPPING_TABLE_PT16	StrappingTbl Pt16
91	STRAPPING_TABLE_PT17	StrappingTbl Pt17
92	STRAPPING_TABLE_PT18	StrappingTbl Pt18
93	STRAPPING_TABLE_PT19	StrappingTbl Pt19
94	STRAPPING_TABLE_PT20	StrappingTbl Pt20
95	FID_TICKS	Fiducial Ticks
96	FID_SPREAD	Fiducial Spread
97	LEVEL_TICKS	Level Ticks
98	INTERFACE_TICKS	Interface Ticks
99	INTERFACE_MEDIUM	Interface Medium
100	ENTER_PASSWORD	Enter Password
101	NEW_PASSWORD	New User Password
102	DEVICE_STATUS	Device Status
103	HISTORY_MESSAGE	History Message
104	HISTORY_CONTROL	History Control
105	RESET_HISTORY	Reset History
106	FID_TYPE	Fiducial Type
107	FID_GAIN	Fiducial Gain
108	WINDOW_705	Window
109	CONVERSION_FACTOR	Conversion Factor
110	SCALE_OFFSET	Scale Offset
111	NEGATIVE_AMPLITUDE	NegThreshold Ampl
112	INTERFACE_AMPLITUDE	IfcThreshold Ampl
113	POSITIVE_AMPLITUDE	PosThreshold Ampl
114	SIGNAL	Signal Strength
115	COMPENSATION	Compensation Mode
116	DERATE_FACTOR	Derating Factor
117	TARGET_AMPLITUDE	Target Amplitude
118	TARGET_TICKS	Target Ticks
119	TARGET_CAL	Targ Calib Value
120	TARGET_OPER_MODE	Target OperMode
121	SEVENXK_DIST_CORRECT	7XK Correction
122	ELECT_TEMPERATURE	Elec Temperature
123	MAX_ELECTRONICS_TEMP	Max Temperature
124	MIN_ELECTRONICS_TEMP	Min Temperature
125	RESET_ELECT_TEMP	Reset Temperature
126	SZ_HYSTERESIS	SZ Hysteresis
127	LCD_LANGUAGE	LCD Language
128	STEAM_CAL_MOUNT	Steam Cal Mount
129	RAMP_SLOPE	Ramp Slope
130	BASE_FID_TICKS	Base Fid Ticks
131	FACTORY_PARAM_1	Factory Param 1
132	FACTORY_PARAM_2	Factory Param 2
133	ECHO_SUMMARY	Echo Summary
134	ECHO_DATA	Echo Data
135	ECHO_DATA_INDEX	EchoData Indx
136	NON_VOL_STAT	Non Vol Stat
137	DATE_CODE	Date Code
138	MAGNETROL_SERIAL_NUM	Magnetrol S/N
139	FIRMWARE_VERSION	Firmware Version
140	LOCAL_AI_DISPLAY	Local AI Display
141	HF_CABLE	HF Cable
142	NSP_VALUE	NSP Value



Enhanced Model 705 Eclipse Guided Wave Radar Transmitter PROFIBUS PA™ Configuration Data Sheet

Copy blank page and store calibration data for future reference and troubleshooting.

Item	Value	Value	Value		
Vessel Name					
Vessel #					
Process Medium					
Tag #					
Electronics Serial #				TROUBLESHOOTING	
Probe Serial #				Working Value	Non-Working Value
LvlUnits					
VolUnits (opt.)					
IfcUnits (opt.)					
IfcVolUn (opt.)					
PrbModel					
PrbMount					
MeasType					
SnsrUnit					
Probe Ln					
PrbLvlUn					
Lvl Ofst					
TblVolUn (opt.)					
StrapTbl (opt.)					
Upr Diel (opt.)					
Dielctrc					
Sensvty					
BlockDis					
SftyZone					
SZHeight					
Threshld					
IfcThrsh (opt.)					
Trim Lvl					
AI Disp					
Dev Addr					
Language					
HF Cable					
Fid Type					
Fid Gain					
Window					
Conv Fct					
Scl Ofst					



Enhanced Model 705 Eclipse Guided Wave Radar Transmitter PROFIBUS PA™ Configuration Data Sheet

Copy blank page and store calibration data for future reference and troubleshooting.

Item	Value	Value	Value	TROUBLESHOOTING	
				Correct Value	Incorrect Value
Neg Ampl					
Ifc Ampl (opt.)					
Pos Ampl					
Compsate					
Targ Cal (opt.)					
OperMode (opt.)					
7xK Corr (opt.)					
SnrCalLo					
SnrCalHi					
PrLvl Lo					
PrLvl Hi					
SZ Hyst					
Software Version					
New Password					
Name:					
Date:					
Time:					

Service Policy

Owners of Magnetrol may request the return of a control or any part of a control for complete rebuilding or replacement. They will be rebuilt or replaced promptly. Controls returned under our service policy must be returned by Prepaid transportation. Magnetrol will repair or replace the control at no cost to the purchaser (or owner) other than transportation if:

1. Returned within the warranty period; and
2. The factory inspection finds the cause of the claim to be covered under the warranty.

If the trouble is the result of conditions beyond our control; or, is NOT covered by the warranty, there will be charges for labor and the parts required to rebuild or replace the equipment.

In some cases it may be expedient to ship replacement parts; or, in extreme cases a complete new control, to replace the original equipment before it is returned. If this is desired, notify the factory of both the model and serial numbers of the control to be replaced. In such cases, credit for the materials returned will be determined on the basis of the applicability of our warranty.

No claims for misapplication, labor, direct or consequential damage will be allowed.

Return Material Procedure

So that we may efficiently process any materials that are returned, it is essential that a "Return Material Authorization" (RMA) number be obtained from the factory prior to the material's return. This is available through Magnetrol local representative or by contacting the factory. Please supply the following information:

1. Company Name
2. Description of Material
3. Serial Number
4. Reason for Return
5. Application

Any unit that was used in a process must be properly cleaned in accordance with OSHA standards, before it is returned to the factory.

A Material Safety Data Sheet (MSDS) must accompany material that was used in any media.

All shipments returned to the factory must be by prepaid transportation.

All replacements will be shipped F.O.B. factory.

Eclipse Guided Wave Radar transmitters may be protected by one or more of the following U.S. Patent Nos. US 6,062,095; US 6,247,362; US 6,588,272; US 6,626,038; US 6,640,629; US 6,642,807; US 6,690,320; US 6,750,808; US 6,801,157. May depend on model.



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